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AMBIENT HYDROCARBON AND OZONE CONCENTRATIONS NEAR A REFINERY

by

Ken Sexton and Halvor H. Westberg

Air Resources Section
Chemical Engineering Department
Washington State University

Grant No. R805376

Project Officer

Joseph J. Bufalini
Atmospheric Chemistry and Physics Division
Environmental Sciences Research Laboratory
Research Triangle Park, North Carolina 27711

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ABSTRACT

An ambient air monitoring study to characterize airborne emissions from petroleum refineries was conducted near the Marathon oil refinery at Robinson, Illinois during June 17 - July 29, 1977. Ground-level sampling facilities and an airplane equipped with air pollutant monitoring instruments provided an integrated, three-dimensional monitoring network. Measurements made during the study included ozone, oxides of nitrogen, sulfur dioxide, methane, carbon monoxide, individual C_2-C_{10} hydrocarbons, halocarbons, condensation nuclei, visual distance and various meteorological parameters. Particular emphasis was placed on determining hydrocarbon and ozone concentrations downwind of the refinery complex. The study focused on three major areas: (1) the characterization of gaseous components within the refinery effluent, especially non-methane hydrocarbons and ozone, (2) natural sunlight bag irradiation experiments to determine the ozone forming potential of refinery emissions, and (3) an investigation of changes in plume chemistry during transport.

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SECTION 1

INTRODUCTION

Petroleum refineries are large and complex installations designed to subject a mixture of liquid hydrocarbons, known as crude oil, to a series of unit processes which separate, convert, treat and blend the crude oil into saleable products. Numerous potential sources of emissions to the air exist throughout the processing scheme and collectively contribute to the primary emissions associated with oil refineries. The most important of these pollutants are hydrocarbons, oxides of nitrogen, oxides of sulfur, and carbon monoxide.[1] It has also been suggested that atmospheric reactions involving these species could result in the production of new and more harmful contamination such as photochemical oxidants.

The monitoring or even checking of all of the possible emission sources in a refinery would be a practical impossibility. The Environmental Protection Agency's publication, "Compilation of Air Pollution Emission Factors,"[2] lists 24 categories of sources within a refinery, ranging in size from huge catalytic cracking units to pipeline valves and flanges. Typically, the air pollutant emissions from the various units in a refinery are based on an estimation of loss as a function of product throughput of the system. For example, the hydrocarbon emission factor for the category "pipeline valves" is given as 28 pounds per thousand barrels per day of refinery capacity. For a fluid catalytic cracking unit, the emission estimation procedure is similar and according to the EPA publication is 220 pounds per thousand barrels of fresh crude feed to the catalytic unit.

Although efforts have been made to monitor emissions from particular units within a refinery complex, most published emission estimates for refinery operations relate back to EPA research studies carried out in southern California refineries in the 1950's.[3] It is readily apparent, therefore, that assessment of the air pollution impact of a major refinery is not a well defined procedure at this time. It is also possible that the data available may not be up-to-date with regard to current refinery practices.

Three years ago, Washington State University (WSU) initiated a study aimed at better defining the impact of refinery emissions on ambient air quality in the vicinity of major refineries. In 1974 and 1975 comprehensive ground and aircraft monitoring programs were conducted around petroleum refineries in Lawrenceville, Il[4] and Benicia, CA[5,6] respectively. As far as we could determine, no aircraft tracking of refinery emissions had been reported prior to the Lawrenceville study (1974).

It was found that at a distance of about 1.5 miles the Lawrenceville refinery plume typically exhibited a non-methane total hydrocarbon level in the 1-2 ppm range, carbon monoxide concentrations of 3-5 ppm, NO_x level about 30 ppb and lower ozone content than areas outside of the plume.

Transport of the refinery plume, as measured by aircraft traverses, showed that the plume could be identified on the basis of elevated hydrocarbon levels out to distances of 25 to 30 miles. The degree of dilution occurring in the plume was similar to what would be predicted using relatively simple atmospheric diffusion models both with regard to plume centerline concentration and to the crosswind integrated concentrations.

Most of the hydrocarbons in the plume were alkanes and therefore are only moderately reactive. Although there was some chemical loss of the photochemically reactive hydrocarbon propene, there was no evidence of the formation of ozone in the plume as it drifted downwind. In fact, the plume was generally deficient in ozone compared to the backgrounds levels.

A more extensive study was conducted during September 1975 near the Exxon refinery at Benicia, CA. As at Lawrenceville, measurements showed increased concentrations of hydrocarbons, oxides of nitrogen, and carbon monoxide, as well as decreased levels of ozone within the Exxon refinery plume. In-plume concentrations were stratified with highest values occurring near the surface and gradually decreasing to the top of the mixing layer. Little change was measured in plume dimensions at distances from 3 to 8 miles downwind of the refinery.

Elevated oxidant levels were observed in the Sacramento River Delta area, approximately 20 miles downwind of Benicia. Natural sunlight irradiation experiments with captured air samples showed that refinery emissions have definite ozone forming potential, with the amount of ozone produced depending to a large extent on the NMHC/NO_x ratio and absolute NMHC concentration. Samples collected in the region of oxidant build-up revealed a hydrocarbon composition similar to typical refinery emissions. However, because of the delta region, it was not possible to quantify the relative contribution of the Exxon plant to observed ozone enhancement.

In 1977, an air monitoring field study was conducted from June 17 to July 29 near the Marathon petroleum refinery at Robinson, Illinois. Ground level and aerial measurements focused on defining air chemistry in the plume, with particular emphasis on investigating photochemical ozone formation in excess of background levels. The Marathon refining complex processes approximately 200,000 barrels of crude oil per day and is located in a rural area of the Midwest where meteorological conditions are favorable for oxidant production during summer months. This report summarizes results obtained from continuous monitoring of gaseous pollutants and meteorological variables at the field laboratory, aerial measurements, and captive air irradiation studies of emissions and background samples.

SECTION 2

EXPERIMENTAL PROCEDURE

SITE DESCRIPTION

The air monitoring program conducted in the Robinson, Illinois area during June 17 - July 29, 1977, involved both ground and aircraft sampling systems. The focal point for ground operations was a 23-foot instrumented trailer that served as a field laboratory. Trailer instruments provided continuous measurements of selected pollutants and several meteorological parameters, as well as gas chromatographic analysis of aircraft and ground collected hydrocarbon samples. Natural sunlight bag irradiation experiments were also conducted at this site.

The field laboratory was positioned at the Robinson Airport, approximately 3 miles east of the Marathon refinery (see Figure 1). From this location it was possible to gather data on ambient "background" pollutant levels and compare these values with measurements made when the Marathon plume drifted over the field laboratory.

An instrumented Rockwell Aero Commander 680FL completed the WSU sampling network. A high wing, twin engine airplane, the 680FL is able to carry a pilot, an instrument operator and approximately 775 pounds of equipment. The WSU aircraft was equipped to make continuous measurements of O_3, NO_x, SO_2, condensation nuclei, visual distance and various meteorological and navigational parameters. Six-liter grab samples were collected in Teflon bags and/or stainless-steel cans and returned to the field laboratory for individual hydrocarbon identification via GC analysis. Aircraft sorties were flown on all days with favorable weather conditions, and on most days, morning and afternoon flights were completed. All aircraft operations originated at the Robinson Airport. Table 1 lists all parameters measured at the field laboratory and onboard the aircraft.

TABLE 1. GROUND AND AIRCRAFT MEASUREMENTS

Ground-Level Measurements

Ozone

Oxides of Nitrogen

Total Hydrocarbon

Methane

Carbon Monoxide

Individual C_2-C_{10} Hc

Halocarbons

Wind Speed

Wind Direction

Turbulence

Dew Point

Solar Radiation

Temperature

Vertical Temperature
Discontinuity
(Acoustic Radar)

Aircraft Measurements

Ozone

Condensation Nuclei

Visual Range (Nephelometer)

Temperature

Relative Humidity

Sulfur dioxide

NO, NO_2, NO_x

Navigational Parameters (VOR, DME, Altitude, etc.)

Bag/Can Samples (hydrocarbons, Halocarbons, NO_x, etc.)

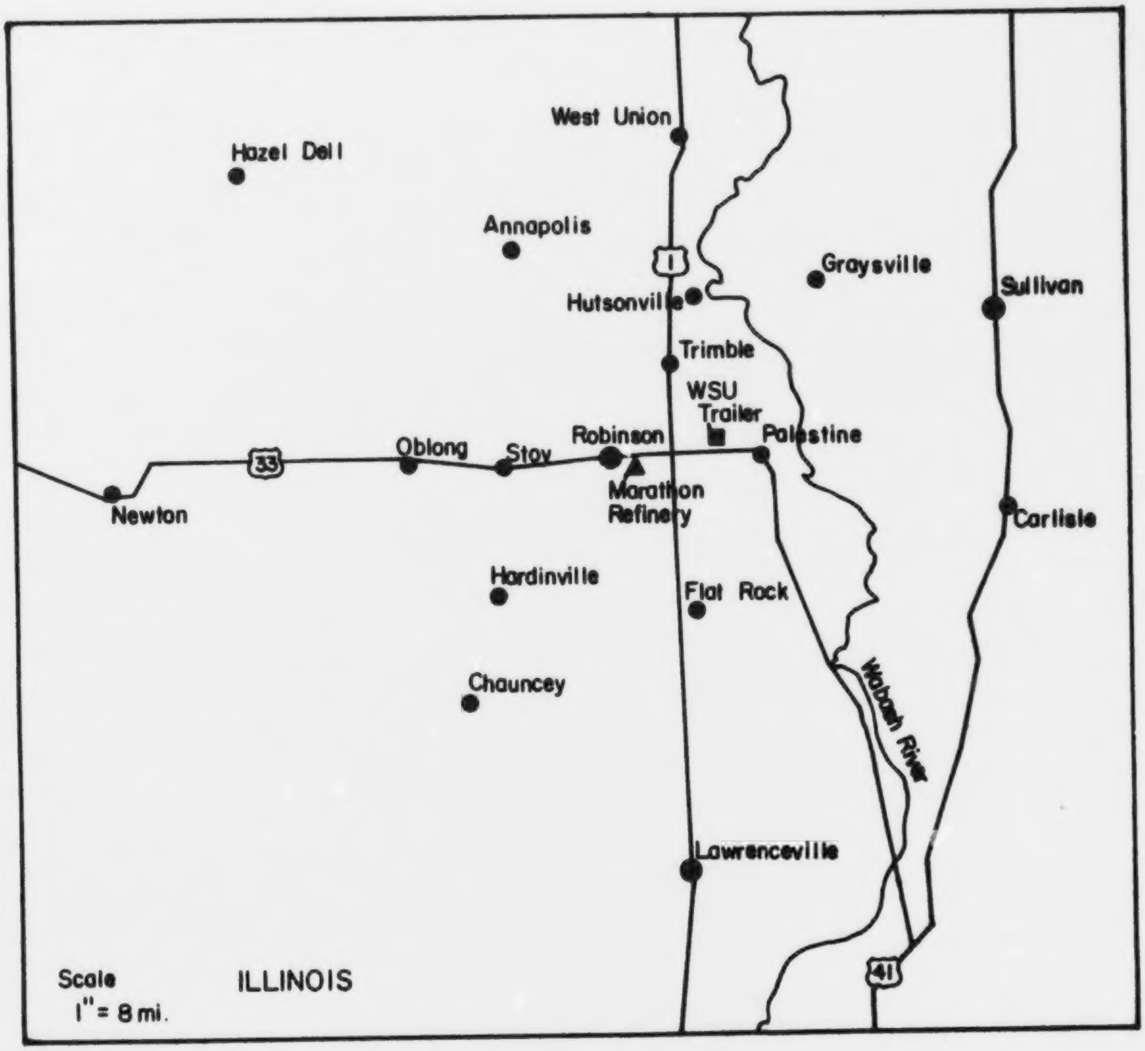
West Union
Hazel Dell
Annapolis
1
Graysville
Sullivan
Hutsonville
Trimble
WSU Trailer
Palestine
Oblong
Stoy
Robinson
33
Newton
Marathon Refinery
Carlisle
Hardinville
Flat Rock
Wabash River
Chauncey
Lawrenceville
41
Scale
1" = 8 mi.
ILLINOIS

Figure 1. Map of Robinson, Illinois area.

GROUND INSTRUMENTATION

Field Laboratory - Robinson Airport

A 23-ft. custom-built travel trailer served as our field headquarters. The laboratory contains 52 ft. of bench and rack space for accommodation of the monitoring instruments, meteorological sensors and data acquisition and reduction system. Most of this equipment is permanently mounted in the trailer for easy transport from site to site. The laboratory can be set up with most instruments fully operational in one day. Constant temperature within the trailer is maintained by two large air conditioners mounted on the roof.

Outside air is brought into the trailer through a 4-inch stainless-steel line. The top of the air inlet stack is about 20 feet above ground level. This sample line runs the full interior length of the trailer and serves as a manifold for supplying the outside air to the continuously monitoring instruments. An air flow rate through the line of approximately 100 cfm is maintained by a squirrel-cage fan at the exhaust end.

Equipment is laid out within the trailer such that those instruments monitoring the reactive gases (ozone and nitric oxide) are closest to the inlet of the manifold.

A brief description of the instruments included in the field laboratory is provided below.

Ozone Monitor - A Bendix Model 8002 Ozone Analyzer was used for ozone measurements. Operation of this instrument is based on the gas-phase chemiluminescent reaction between ozone and ethylene, which produces light energy in the 300 to 600 nm region. The light emitted is detected by a photomultiplier tube and converted to an electrical signal compatible with recording devices.

NO, NO_2, NO_x Monitor - We employed a TECO Model 14D for oxides of nitrogen measurements. This instrument employs the chemiluminescent reaction between nitric oxide and ozone as the detection technique. The 14D has dual chambers; one for NO and another for NO_x. It is capable of selective detection of NO, NO_2, NO_x. It has a lower sensitivity limit of approximately 5 ppb for NO, NO_2, NO_x.

Methane, Carbon Monoxide and Total Hydrocarbon Monitor - a Beckman Model 6800 Air Quality Gas Chromatograph was used for these measurements.

This automated gas chromatograph employs a flame ionization detector for hydrocarbon analysis. Carbon monoxide is reduced to methane prior to entering the detector. This instrument provides a CH_4, CO and THC reading at 5 minute intervals and is interfaced with our computer system for data reduction.

Halocarbon Monitor - A Hewlett Packard Model 5700A Gas Chromatograph equipped with a constant-current ^{63}Ni electron capture detector was used to monitor ambient levels of fluorocarbon-11, chloroform, fluorocarbon-113, methylchloroform, carbon tetrachloride and trichloroethene. Separation was achieved on a 10-foot x 1/8-inch O.D. stainless-steel column containing 10% SF-96 on Chromosorb W. The column was maintained at 55°C. With a carrier gas (95% argon - 5% methane) flow of 30 ml/min., three analyses could be run each hour. This instrument was automated by attaching a 1-ml sample loop, a Carle Microvalve (#5518), a Carle valve actuator (#4201) and a Carle valve minder (#4101). A manual technique was used for injecting aircraft collected samples.

Climet CI-60 Data System - This instrument package contained sensors for measuring wind speed, wind direction, dew point, temperature and solar radiation. Output from the various sensors was channeled into a translator which conditions the signals and provides an output voltage compatible with the data-logging system. A measure of air turbulence was calculated from time-averaged standard deviations in wind direction.

Individual Hydrocarbon measurements - These measurements were made with Perkin Elmer Model 900 Gas Chromatographs. The standard dual-flame instrument was used with the addition of a sub-ambient accessory. The normal carrier gas flow system was modified to include a freeze-out trap for concentrating organics in ambient air. The column used to separate light hydrocarbons was a packed capillary (20' x 1/16) containing Durapak n-octane/Porasil C. When operated with a carrier gas (He) flow of ~5 ml/min. and temperature-programmed from -60 to 80° at 24°/min., this column provided excellent resolution of the C_2-C_5 hydrocarbon fraction. This hydrocarbon analysis method was not automated. Analysis for hydrocarbons in the C_5-C_{10} molecular weight range was performed on a 30 meter SE-30 glass capillary column. The same type of cryogenic concentration procedure described for light hydrocarbons was used. The resolving power of the glass capillary column was enhanced by employing a sub-ambient temperature-programming method.

Mass Spectometric Analysis (performed at WSU laboratory in Pullman, WA) - A Hewlett Packard 5930A Mass Spectrometer coupled with a Hewlett Packard 5700 Gas Chromatograph was employed for gc-ms analysis. The mass spectrometer is a standard quadrupole instrument which has been modified by the addition of a second 4-inch diffusion pump. The glass capillary columns we use for hydrocarbon analyses required a low carrier gas flow rate (< 10 ml/min.). This, coupled with the extra pumping capacity, permits the total gc column effluent to be passed directly into the mass spectrometer. Thus, the mass spectrometer serves exactly the same function as the flame ionization detector; and a chromatogram resulting from the flame detector will be nearly identical to that recorded by monitoring the total ion current in the mass spectrometer. This makes it relatively easy to verify peak assignments. Samples collected and analyzed in the field using the flame ionization detector were shipped to our mass spec laboratory where they were analyzed using the same chromatographic conditions as in the field. Hydrocarbon identities reported in this study were based on retention time comparisons with standards plus mass spectral fragmentation patterns.

The ground instruments, with the exception of the Perkin Elmer 900 Gas Chromatograph, obtained air samples on a continuous basis from the trailer monifold. Samples for hydrocarbon analysis were taken from the trailer manifold, Teflon bags or metal canisters. The canisters were constructed of stainless steel with all the inner surfaces polished using the "Summa" process. The cans were filled with air using a metal bellows pump and sealed by closing two bellows valves. By pressurizing these containers to 10 psig, about 5 liters of air could be obtained for sampling purposes. These stainless-steel containers provided the means by which ambient air samples could be returned to our home laboratory in Pullman, WA for mass spectrometric analysis.

Additional Meteorological Measurements

Aerovironment Model 300 Monostatic Radar - This acoustic sounder measures the turbulent fluctuation of atmospheric temperature on electrosensitive chart paper. A continuous record of the intensity of echo return as a function of height and time is obtained. The instrument has a maximum vertical range of 1000 meters.

Warren-Knight Model 84 Double Center Theodolite - Pilot balloons were used in conjunction with this theodolite for monitoring upper-level wind speed and direction. The balloons were of the 30g type and the standard rise rate table was used for computations.

AIRCRAFT INSTRUMENTATION

A Topaz solid-state inverter was used to convert the 28-VDC aircraft generator output to 120-VAC for operating the air pollutant analyzers. This inverter provided about 1500 watts of usable power.

Air to be used for analysis was brought into the aircraft through a 4-inch diameter sampling probe extending approximately 10 inches outboard of the right side of the fuselage. The probe was connected to a 4-inch diameter, clear plexiglass manifold inside the aircraft, which extended down the right side of the cabin and vented through the rear wall into the baggage compartment. Air from the sampling manifold reached the instruments through ¼-inch Teflon tubing. The large size of the sampling probe and manifold provided ample air flow for all equipment.

Ozone Monitor - Bendix Model 8002 Chemiluminescent Analyzer was used to measure ozone levels aloft. The response time (< 10 seconds for 90% response) of this instrument is sufficiently rapid for meaningful aircraft measurements. Ozone analyzers of the type used in this study respond to changes in atmospheric pressure. Ground level pressure changes are minor and need not be of concern. However, when an instrument is carried aloft, pressure factors must be considered. All aircraft collected data have been corrected using equations developed from pressure chamber studies.

Condensation Nuclei - An Environment One Rich 100 Analyzer was used to measure very small particulate material in the atmosphere. This unit responds to particles with diameters of 0.0025 micron and larger and it spans a concentration range of 300 to 10^7 particles per cubic centimeter. Response time for this instrument is 3 seconds, which makes it very suitable for airborne measurements.

Nitrogen Oxides - A Monitor Labs Model 8440 Nitrogen Oxides Analyzer was used for the measurement of NO and NO_x. This instrument employs the chemiluminescent reaction of nitric oxide and ozone to measure nitric oxide concentrations. NO_2 is determined by first converting the NO_2 to NO and subsequently measuring the total nitric oxide ($NO + NO_2$) by the chemiluminescent method. The NO_2 concentration is then determined by the difference of ($NO + NO_2$) and NO. This instrument has a separate photomultiplier tube for the NO and NO_x channels, which is important for aircraft work where large distances are covered in a short period of time.

Hydrocarbon and Halocarbon Analysis - Stainless-steel canisters pressurized by a carbon vane pump were used for collecting samples for hydrocarbon and halocarbon analysis. All analyses were performed at the ground laboratory shortly after completion of the flight.

Temperature, Relative Humidity and Navigational Parameters - A Metrodata M8 Airborne Meteorological and Navigational System was used to measure temperature, humidity, air speed, altitude, bearings from two points (VOR) and distance from one point (DME). The temperature and humidity data are derived from sensors mounted near the sampling probe. The air speed and altitude systems use potentiometric transducers, which are connected to the aircraft pitot-system. VOR/DME data are acquired from navigational receivers installed in the aircraft.

Visual Range - A MRI Integrating Nephelometer was used to monitor light scattering and visual range. Air was not dried before entering the analyzer tube so changes in atmospheric humidity must be taken into account when examining these data. The quantitative output of this instrument was given in units of scattering coefficient and meteorological range (visual distance). Sensitivity for scattering coefficient is 0.1 to 100 x 10^{-4} m^{-1} and for local visual distance is ∞ to 0.3 miles. We used a flashlamp rate of 16/second and an averaging time (time constant) of 0.1 second.

SO_2 Monitor - SO_2 measurements were made using a factory modified for fast response Thermal Electron Model 43 Pulsed Fluorescent Analyzer. Capable of measuring SO_2 on a continuous real-time basis, the Model 43 provides an inherent linear sensitivity between 2 ppb and 5 ppm. The unit is totally self-contained and insensitive to changes in flow and temperature.

CALIBRATION PROCEDURES

A comprehensive data quality control program is an essential part of all field studies. Instrument calibration and zero checks must be documented so that any questions concerning data quality can be resolved. We kept daily records of these events and have used this information in arriving at the numbers provided in this report. Any data that appeared questionable were not included. A summary of precautions taken to insure data integrity for the various measurements is provided below.

Ozone - The ground based and airborne ozone analyzers were calibrated at least once a week using a McMillan 1000 Ozone Generator. This ozone source provided outputs from 0 to 1000 ppb. Daily zero checks were made in the field on the ground ozone instrument. However, in the aircraft, numerous checks were made during each flight. The airborne ozone data has been adjusted for zero drift whenever necessary.

Absolute calibration of the McMillan generator was performed at Washington State University prior to the field trip. Both the standard KI method and spectral measurements using a Dasibi Model 1003-AH ultraviolet ozone photometer were employed. Excellent agreement was obtained when comparing these two calibration methods.

Oxides of Nitrogen - The ground based and airborne oxides of nitrogen analyzers were span checked once a week with zero checks performed on a daily basis. Our span gas was a 1.0 ppm NO tank obtained from AIRCO. The tank concentration was verified by gas phase titration at the WSU laboratory. Prior to the field study, comprehensive calibration checks were performed on the trailer and aircraft oxides of nitrogen analyzers. Various nitric oxide concentrations in the .04 to 1.0 ppm range were generated using a Meloy Model CN020 Nitrogen Oxides/Ozone Calibrator. The instruments responded in a linear fashion throughout this concentration range.

Total Hydrocarbon, Methane and Carbon Monoxide - The Beckman 6800 AQGC was calibrated using a tank containing 7.2 ppmC (THC), 2.19 ppm methane and 2.00 ppm carbon monoxide. The hydrocarbon mixture in the calibration tank was standardized relative to hexane. Calibration checks were made every other day.

Fluorocarbon-11 and Carbon Tetrachloride - The electron capture gas chromatograph was calibrated from standards made up in ambient air. At the present time, we feel this is the best method since the moisture and oxygen content of the standard will be nearly the same as in samples collected during routine analysis periods. The calibration was based on a Freon-11 standard that had been certified by mass spectrometry. Samples from this standard were run daily throughout the study period in order to monitor stability of the electron capture detector. Other halocarbon calibrations were carried out in a similar manner.

Individual Hydrocarbons - Identification of the light hydrocarbons (C_2-C_5) was based on retention time comparisons. Resolution of light hydrocarbons on the Durapak n-Octane/Porasil C column was excellent and retention times were extremely reproducible. Thus, little difficulty existed in making unambiguous peak identifications. Calibration of the Perkin Elmer gas chromatographs was achieved by measuring instrument response to known concentrations of hexane in air. Three different hexane sources were used to prepare standards in the ppb range. In the field, an external standard (neo-Hexane, .209 ppm) was periodically injected in order to insure calibration reliability. Heavy hydrocarbon (C_6-C_{10}) identities were determined through retention time comparisons with known standards plus mass spectral analysis. Instrument calibration was performed in the same manner as mentioned above for the light hydrocarbons.

Meteorological Parameters - Calibration curves supplied by the manufacturer were used to convert the Climet CI-60 sensor output signals to the appropriate temperature, wind speed, etc., readings. While in the field, sensor signals were checked routinely to insure correct operation.

Particulate Measurements - The condensation nuclei counter and nephelometer were calibrated in our home laboratory prior to going into the field. No calibration checks were made in the field since their primary function was not to provide absolute numbers, but rather to determine gross horizontal and vertical inhomogeneities within an air mass. We were concerned only with relative differences.

SO_2 - Calibration procedures using SO_2 permeation tubes were performed at WSU prior to summer field operations. Because aircraft SO_2 measurements were aimed at delineating only relative SO_2 concentration differences between pollutant plumes and ambient air, no calibration checks were made in the field.

DATA HANDLING PROCEDURES

All data collected in the aircraft and from most continuous monitoring ground instruments were recorded on 4-track magnetic tape using Metrodata Model DL620A data logging systems. Output from the gas chromatographs was channeled directly into a Hewlett Packard 3352 data system. This system provided individual hydrocarbon identification and quantitative information immediately following each GC run.

We have developed the software necessary to allow our HP2100 mini-computer (basic component of HP3352 data system) to process 4-track magnetic tape data in the field[7]. This permits field personnel to look at nearly a complete data set each day, which is very advantageous from the standpoint of recognizing instrumental malfunctions as well as short-term pollutant relationships that warrant further study. The hardware involved in this operation includes a Metrodata Model TR625 tape reader, the Hewlett Packard 2100 computer, a Printec 100 high speed printer and teletype for communicating with the system. The data processing operation involves converting raw voltages to scientific units, plus time averaging and tabulating for easy review.

The frequency of data recording in the field was dependent on the sampling technique. In the aircraft, where considerable distance was covered in a short time, instrument and sensor responses were recorded five times every two seconds. Under normal flying conditions, this corresponds to a data point approximately every 90 feet. On the ground, where pollutant and meteorological parameters were monitored at a fixed point, data recording times varied from one minute for ozone, oxides of nitrogen and the meteorological sensors to 20 minutes for the halocarbons.

Field data collected on 4-track magnetic tape were transferred to 9-track tape in our home laboratory. This provides a permanent storage mechanism plus a data format compatible with WSU's IBM-360 computer.

SECTION 3

CAPTIVE AIR IRRADIATION STUDIES

Natural sunlight bag irradiation experiments were used to examine the photochemical ozone-forming potential of Marathon emissions. Three 500-liter Teflon bags were filled during the early mornings, with two normally collected near the refinery fenceline and the third near the WSU field laboratory. Typically, samples were collected between 0700-0830 CDT to insure that emissions were fresh and not photochemically "aged." Bags were shielded from direct sunlight immediately after collection so that all three bags could be exposed simultaneously at the field laboratory site. Occasionally, one of the in-plume samples was "spiked" with additional nitric oxide to investigate the effect of varying NMHC/NO_x ratios on ozone formation. Hydrocarbon samples for GC analysis were drawn from each bag prior to irradiation and, in some cases, samples were also taken at the conclusion of a run. All bags were irradiated with natural sunlight for six to eight hours and changes in NO, NO_2, and O_3 monitored periodically.

Table 2 gives a summary of all irradiation experiments conducted during the field monitoring program. Samples labeled plume were normally collected at the refinery fenceline in the area where WSU personnel could smell refinery-type odors. A few samples were collected approximately one mile downwind using this same technique to locate the plume (see Appendix D). Because the time required to fill one bag was approximately 20 minutes, changes in wind direction after filling was initiated could result in a mixture of refinery emissions and cleaner background air being labeled a "plume" sample. The wide variation in Table 2 for plume hydrocarbon concentrations probably results from a combination of many factors, including sampling at varying distances from the plume centerline, wind shifts, and the prevailing local meteorological conditions.

Data from Table 2 suggest that emissions from the marathon refinery have the potential to produce significant quantities of photochemical ozone

TABLE 2 . SUMMARY OF NATURAL SUNLIGHT BAG IRRADIATION EXPERIMENTS

DATE	SAMPLE	MAX SOLAR RADIATION (a) (mly)	MAX TEMP.(a) (°F)	INITIAL NO (ppb)	INITIAL NO_2 (ppb)	INITIAL NMHC (ppbC)	$NMHC/NO_x$	MAX O_3(a) (ppb)	ΔO_3(b) (ppb)	COMMENTS
6-26-77	ambient background (a)	1326	87	5	3			64	35	clear AM scattered clouds PM
	Refinery Plume			16	22	451	12	144	143	
6-18-77	ambient background (a)	966	88	7	3			41	29	experiments discontinued at 1300 CDT due to rain
	out of plume			4	2			26	11	
	Refinery Plume			2	7	1242	138	24	5	
6-29-77	ambient background (a)	1386	82	6	7			46	24	clear AM scattered clouds PM
	out of plume			2	6	177	22	40	27	
	Refinery Plume			2	8	507	51	71	59	
	Refinery Plume			4	7	428	39	74	63	
6-30-77	ambient background (a)	1303	91	9	6			46	16	hot, humid, overcast
	out of plume			5	2	177	25	27	15	
	Refinery Plume			40	28	2011	30	230	220	
	Refinery Plume			26	27	1022	19	157	147	

(a) continuous measurements at the WSU field laboratory (ambient background max O_3 refers to highest hourly average).
(b) O_3 maximum during a run minus initial O_3 measured in the bag (for ambient background max hourly average minus initial hourly average).
(c) spiked with NO. (d) Bag leaked. (e) missing value. (f) Refinery Plume Fumigating WSU trailer.

TABLE 2. continued

DATE	SAMPLE	MAX SOLAR RADIATION (mly) [a]	MAX TEMP. (°F) [a]	INITIAL NO (ppb)	INITIAL NO_2 (ppb)	INITIAL NMHC (ppbC)	$NMHC/NO_x$	MAX O_3 (ppb)	ΔO_3 (ppb) [b]	COMMENTS
7-1-77	ambient background [a]	1390	82	9	3			46	25	scattered clouds
	out of plume			3	5	109	14	61	50	
	Refinery Plume [c]			51	8	1466	24	170[d]	170	
	Refinery Plume			1	4	2758	552	53	66	
7-2-77	ambient background [a]	1381	85	4	3			65	40	
	out of plume			2	6	437	55	72	61	
	Refinery Plume [c]			77	5	11863	145	422	422	
	Refinery Plume			1	6	2678	383	56	36	
7-3-77	ambient background [a]	1070	86	4	5			69	35	hazy, high scattered clouds
	out of plume			2	5	109	16	40	19	
	Refinery Plume			4	7	31772	2888	18	17	
	Refinery Plume			9	22	1140	37	178	176	
7-4-77	ambient background [a]	1307	94	e	2			67	39	BAG B
	out of plume			2	2	131	22	54	25	Irradiation discontinued at 1430 CDT
	Refinery Plume			2	4	2156	359	54	36	
	Refinery Plume			2	20	340	16	158	149	

---

a continuous measurements at the WSU field laboratory (ambient background max O_3 refers to highest hourly average)

b O_3 maximum during a run minus initial O_3 measured in the bag (for ambient background max hourly average minus initial hourly average)

c spiked with NO d Bag leaked e missing value f Refinery Plume Fumigating WSU trailer

TABLE 2. continued

DATE	SAMPLE	MAX SOLAR RADIATION (mly) [a]	MAX TEMP. (°F) [a]	INITIAL NO (ppb)	INITIAL NO_2 (ppb)	INITIAL NMHC (ppbC)	$NMHC/NO_x$	MAX O_3 (ppb)	ΔO_3 (ppb) [b]	COMMENTS
7-5-77	ambient background [a]	1339	94	8	9			81	53	the bag collected near the WSU trailer was filled when the refinery plume was fumigating the site
	Refinery Plume [f]			5	11	437	27	95	77	
	Refinery Plume			5	14	1200	63	122	107	
	Refinery Plume			2	8	391	39	92	72	
7-6-77	ambient background [a]	1307	96	8	16			59	29	humid, hazy sunny
	out of plume			1	10	180	16	82	67	
	Refinery Plume			2	16	3948	219	200	190	
	Refinery Plume [c]			42	25	4786	71	309	309	
7-7-77	ambient background [a]	1301	96	20[f]	15[f]			78	49	the bag collected near the WSU trailer was filled when the Refinery Plume was fumigating the site
	Refinery Plume [f]			4	9	703	54	116	94	
	Refinery Plume [c]			215	70	3306	12	470	479	
	Refinery Plume [c]			110	40	2458	16	415	415	

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a continuous measurements at the WSU field laboratory (ambient background max O_3 refers to highest hourly average).
b O_3 maximum during a run minus initial O_3 measured in the bag (for ambient background max hourly average minus initial hourly average).
c spiked with NO. d Bag leaked. e missing value. f Refinery Plume Fumigating WSU trailer.

TABLE 2. continued

DATE	SAMPLE	MAX SOLAR RADIATION[a] (mly)	MAX TEMP.[a] (°F)	INITIAL NO (ppb)	INITIAL NO_2 (ppb)	INITIAL NMHC (ppbC)	$NMHC/NO_x$	MAX O_3 (ppb)	ΔO_3 (ppb)[b]	COMMENTS
7-8-77	ambient background[a]	1060	93	10[f]	15[f]			79	48	thunder storms in the PM
	out of plume			2	9	136	14	56	44	
	Refinery Plume			310	70	1810	6	29	29	
	Refinery Plume[c]			510	40	788	2	0	0	
7-14-77	ambient background[c]	1263	93							
	out of plume			4	2	180	30	61	54	sunny, humid, hazy
	Refinery Plume[c]			74	15	448	5	100	98	
	Refinery Plume[c]			180	35	419	2	20	19	
7-15-77	ambient background[a]	1219	95							the bag collected near the WSU trailer included some refinery emissions
	Refinery Plume[f]			4	13	296	17	81	77	
	Refinery Plume[c]			94	34	3220	25	315	315	
	Refinery Plume[c]			200	41	6594	27	445	445	
7-18-77	ambient background[a]	1297	94							
	out of plume			0	7	312	45	71	52	hazy, humid
	Refinery Plume			3	3	8348	1391	70	54	
	Refinery Plume			3	4	1608	230	69	41	

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[a] continuous measurements at the WSU field laboratory (ambient background max O_3 refers to highest hourly average).

[b] O_3 maximum during a run minus initial O_3 measured in the bag (for ambient background max hourly average minus initial hourly average).

[c] spiked with NO. [d] Bag leaked. [e] missing value. [f] Refinery Plume Fumigating WSU trailer.

under the experimental conditions already mentioned. When irradiated, captive air samples collected outside of the refinery plume showed maximum ozone production varying from 10-65 ppb. Irradiation studies involving in-plume samples, however, revealed ozone build up in excess of 400 ppb on several occasions. While highest ozone formation was recorded during experiments where Marathon emissions were "spiked" with NO in order to obtain a more favorable HC/NO_x ratio, non-spiked plume samples did generate peak ozone concentrations on the order of 200 ppb.

Figure 2 illustrates the variations in ozone concentrations observed during the captive air irradiation experiments on July 6, 1977. Clearly, the samples representative of refinery emissions exhibit a greater capacity for photochemical ozone generation over the eight-hour irradiation period than the out-of-plume sample collected at the WSU trailer. Continuous ambient air measurements at the field laboratory are also plotted in Figure 2 and show relatively good agreement with the bag sample taken at the trailer site.

Ozone production recorded during the natural sunlight bag irradiation experiments also reflects the influence of NMHC/NO_x ratios and absolute hydrocarbon concentrations. Several investigators have reported smog chamber results indicating maximum ozone formation at specific HC/NO_x ratios.[8,9] These same studies also show a direct relationship between peak ozone values and absolute hydrocarbon levels. An examination of all captive air irradiation experiments reveals a similar pattern for the 1977 study period. Figure 3 displays the observed effect of NMHC/NO_x ratios and initial NMHC concentrations on ozone formation recorded in the chambers. Highest O_3 production for all samples was observed at NMHC/NO_x ratios between 10-20, however, it is obvious from Figure 3 that the amount of O_3 formed varied directly with NMHC concentration. The relationship between initial NMHC concentrations and ozone production for in-plume samples is further illustrated in Figure 4.

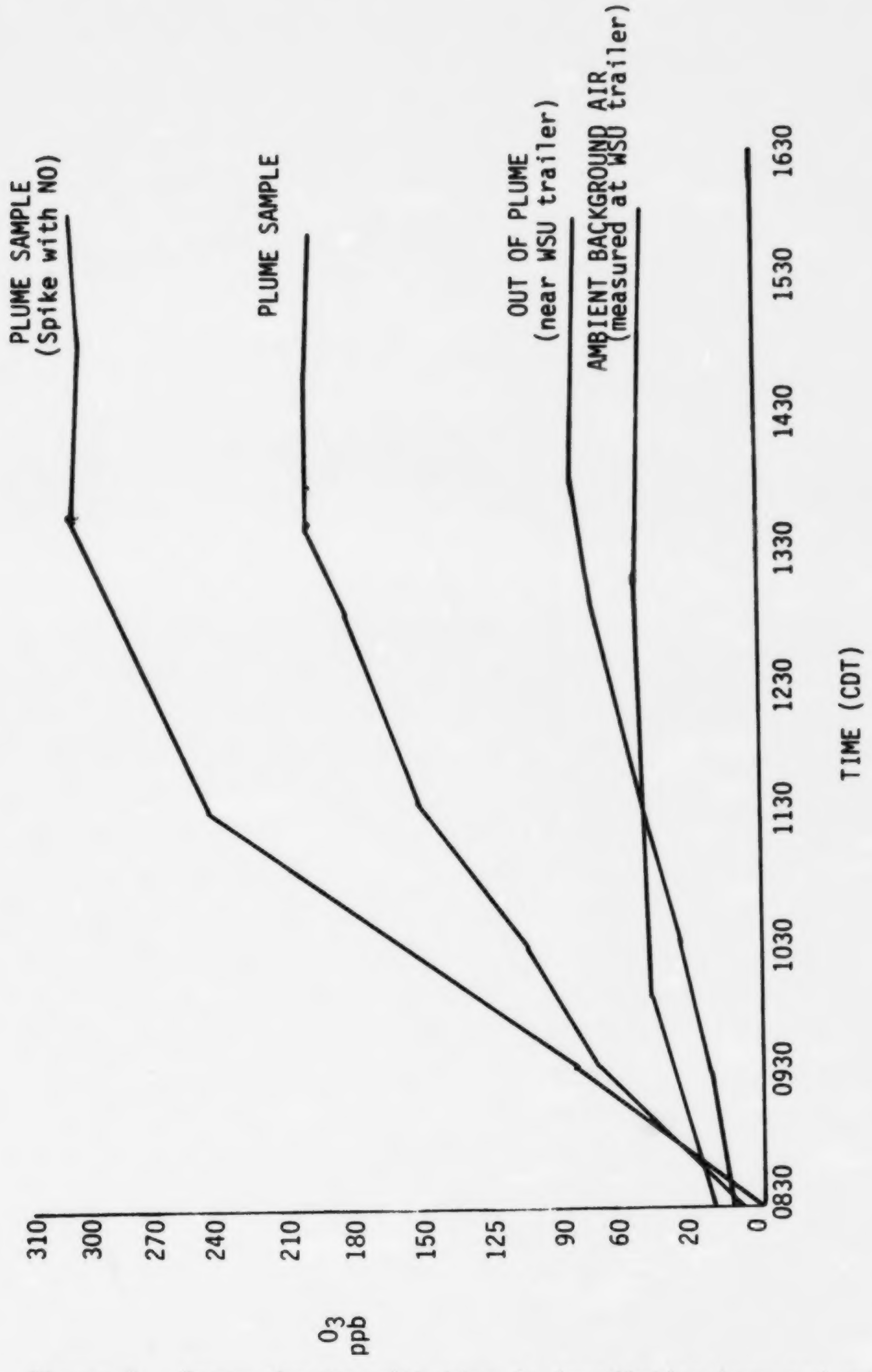

Figure 2. Ozone changes with time in irradiation bags and ambient air on July 6, 1977.

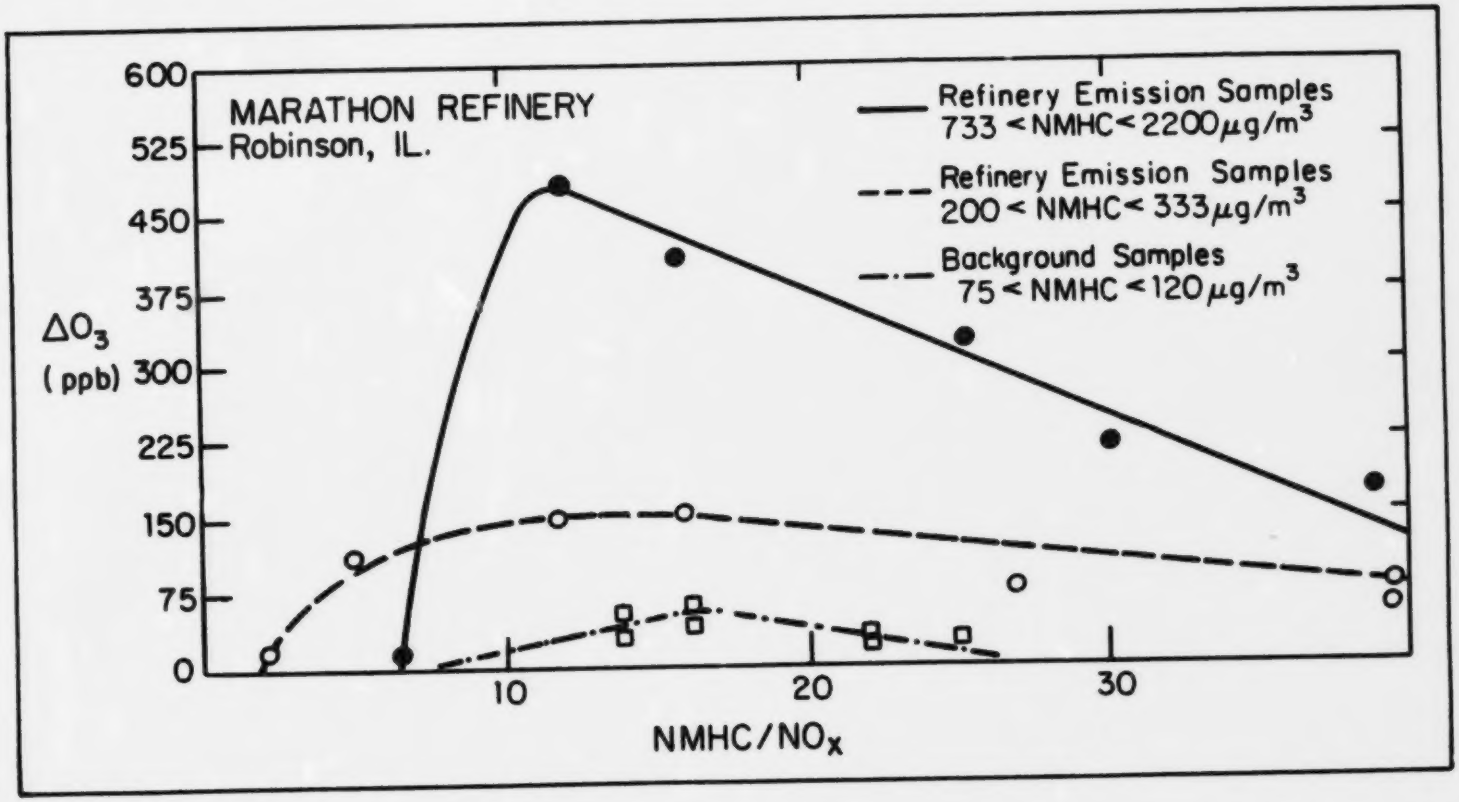

Figure 3. Dependence of ozone production on $NMHC/NO_x$ ratio.

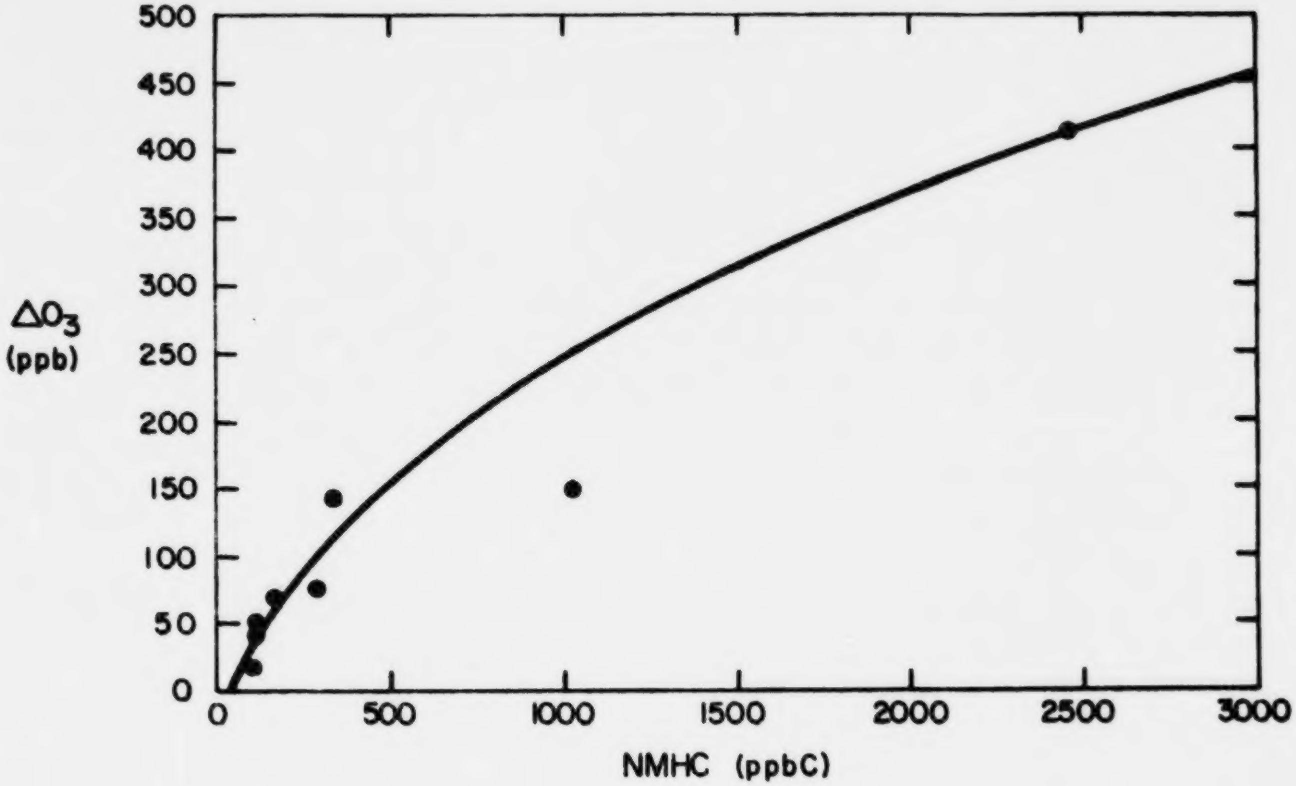

Figure 4. Dependence of ozone production on initial NMHC concentration.

SECTION 4

AERIAL MEASUREMENTS

Ambient air measurements downwind of the Marathon refinery indicate increased SO_2, and CN values were consistently recorded within the area of plume drift. In-plume ozone concentrations, on the other hand, exhibited marked variations throughout the sampling period. At distances less than three miles from the plant, O_3 values within the plume boundaries were typically less than background levels, primarily due to scavenging of O_3 by nitric oxide (NO). Beyond three miles downwind, in-plume O_3 levels varied widely, with early morning flights (before 1000 CDT) consistently showing ozone depletion out to 10 or 15 miles, while data from later in the day (1000 - 1600 CDT) reveal occasional instances of ozone production in excess of ambient background levels.

Aerial measurements indicate in-plume ozone concentrations exceeded background levels on July 8th and July 21st. Considering the total number of flights completed (16), plume ozone buildup was recorded on only 13 percent of the flights. However, not all of the aircraft sorties were conducted during periods when photochemical ozone generation was a viable possibility. Only seven flights were completed between 1000 - 1600 CDT (maximum solar radiation and adequate temperatures) and weather conditions were not favorable for photochemical activity during the flight on 6/20. Thus, of the six flights during which in-plume ozone formation might have been expected, definite ozone enhancement was attributable to Marathon emissions 33% of the time.

Because of the complexities of atmospheric chemistry and meteorological processes, there is no shortage of plausible explanations for the lack of observed ozone buildup on 2/3 of the flights accomplished from 1000 - 1600 CDT. Plume dispersion is a function of many variables, including such factors as wind speed and direction, turbulence, mixing depth, and local terrain. Therefore, even if adequate UV radiation and temperature are available to initiate photochemical reactions, atmospheric conditions may promote rapid mixing of emissions with background air and thereby dilute pollutant concentrations immediately downwind of the source. The importance of HC/NO_x ratios and absolute hydrocarbon concentration for photochemical ozone production has already been discussed, and the effect of atmospheric dispersion can have a significant impact on both parameters.

Other factors such as synoptic meteorology and background pollutant levels can also influence in-plume ozone levels. The relationship between migratory high pressure systems and pollutant levels in the Midwest has been documented by several investigators.[10,11,12] Northerly winds associated with the leading edge of the anticyclone bring relatively clean air into the region. As the high becomes centered over a particular location, winds become light or calm and local emission sources are the major contributors to ambient pollutant levels. The trailing edge of the high pressure system results in southerly winds and higher pollutant concentrations, since the air mass has passed over the highly industrialized region of the upper Midwest and northeastern U.S. The changes in background pollutant levels, specifically HC, NO_x and O_3, could affect photochemical processes within the Marathon plume by altering in-plume concentrations during entrainment of background air.

Variations in emission types or quantities could also affect plume chemistry. Process changes, amount of storage capacity utilized and differences in through-put between shifts could affect hydrocarbon and NO_x emission rates. The effect of fluctuation in airborne discharges may account, in part, for the seeming random nature of O_3 production downwind of the refinery.

In the two cases where in-plume O_3 buildup was observed (7/8 and 7/21), certain similarities were apparent. Both flights occurred between 1000 and 1400 CDT with refinery emissions drifting to the north of Robinson under the influence of prevailing southerly winds. Solar radiation during each flight exceeded 1.0 Ly, while maximum temperatures were greater than 78°F. In-plume ozone levels were higher than background values out to at least 15 miles, with maximum enhancement 30 ppb on 7/8 and 15 ppb on 7/21. Data from both days indicate emissions were stratified in the area of plume drift, with highest pollutant concentrations, maximum plume width and peak ozone production measured at lowest altitudes during cross-plume passes.

Detailed information collected during flights on 7/9, 7/21 and 7/8 are presented below. The flight on 7/9 illustrates ozone depletion within Marathon plume boundaries during an early morning mission. Data from 7/21 provides an example of O_3 depletion during an early morning flight followed by O_3 enhancement during a later mission. Highest in-plume ozone buildup was recorded during the flight on 7/8.

July 9, 1977

The instrumented aircraft completed a plume definition flight between 0754 - 1005 CDT on July 9, 1977. Sunny and warm conditions prevailed throughout the flight, with winds from the northeast at 10 kts. The Marathon effluent was observed to the southwest of the refinery and was tracked for approximately 30 miles downwind.

Figure 5 shows the flight path and the approximate location and dimensions of the refinery plume recorded at 500 ft. AGL. Widest plume dimensions and greatest pollutant concentration deviations from background levels were measured at this altitude. No Marathon emissions were detected above 1000 ft. Aerial measurements indicate a temperature inversion between 1000 - 1500 ft. MSL inhibited vertical mixing. Acoustical sounder tracings (Appendix E) confirm the presence of an inversion at 750 - 900 ft. AGL on the morning of the 7th, persisting until approximately 1030 CDT. Ozone concentrations reflected the temperature discontinuities aloft. Ambient background levels at 1500 ft. were approximately 70 ppb, while at 500 ft., below the temperature inversion, ozone values out of the plume were on the order of 40 ppb.

During this flight several attempts were made to fly downwind of the refinery along the approximate plume centerline in order to investigate changes in pollutant concentrations with distance from the plant. This type of operation is especially difficult when there are no visible emissions to mark plume boundaries. The approach used by WSU personnel involved lining up with the prevailing wind direction upwind of the plant and then flying on a straight line downwind, directly over the refinery complex and into the area of plume drift. By monitoring changes in pollutant levels, such as O_3 and SO_2, it was possible to determine when the plane had exited the plume. Figure 6 presents the best results obtained on July 9th from this type of flight.

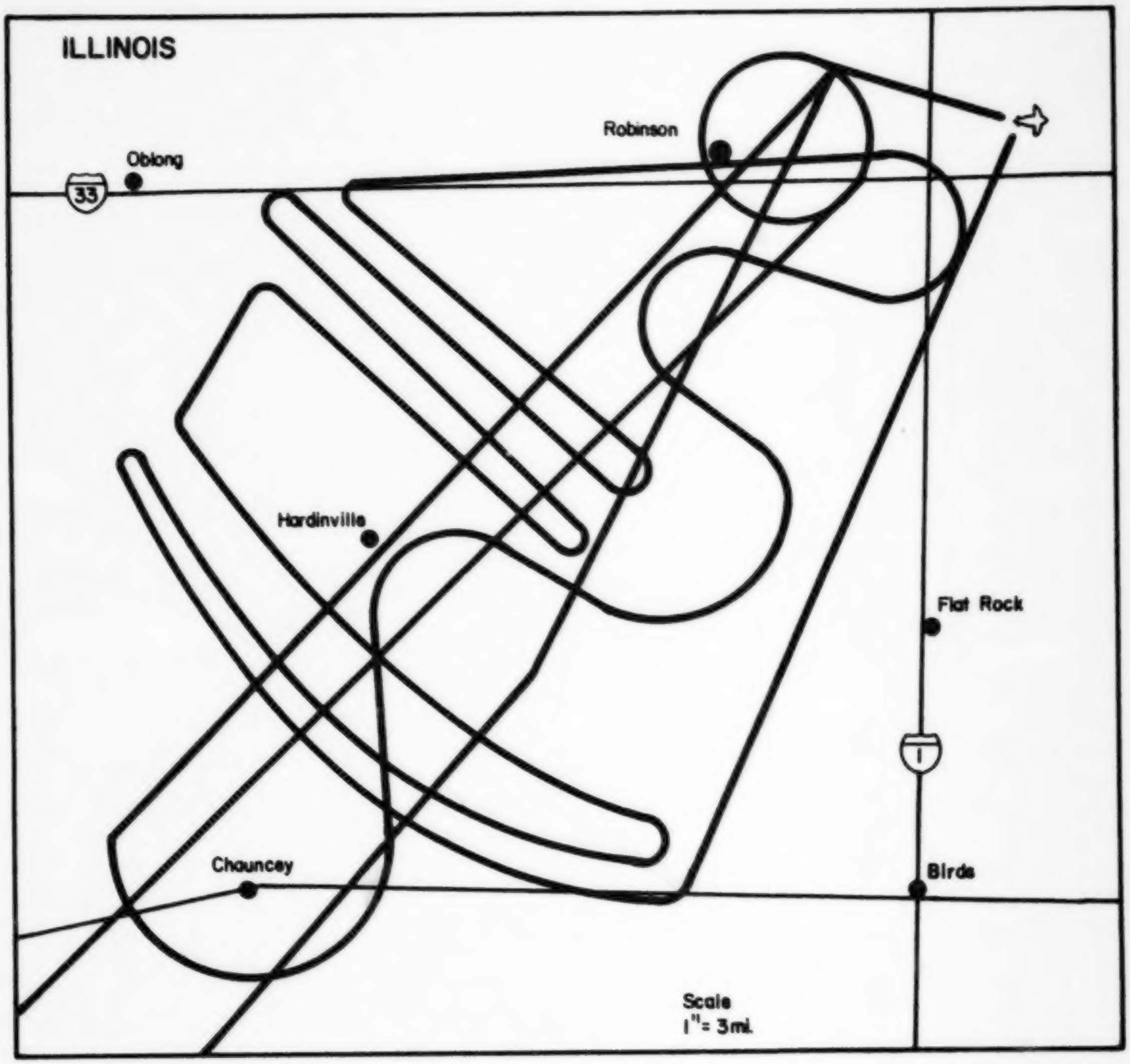
ILLINOIS
Oblong
33
Robinson
Hardinville
Flat Rock
I
Chauncey
Birds
Scale
1" = 3mi.

Figure 5. Refinery plume location during the morning hours on July 9, 1977

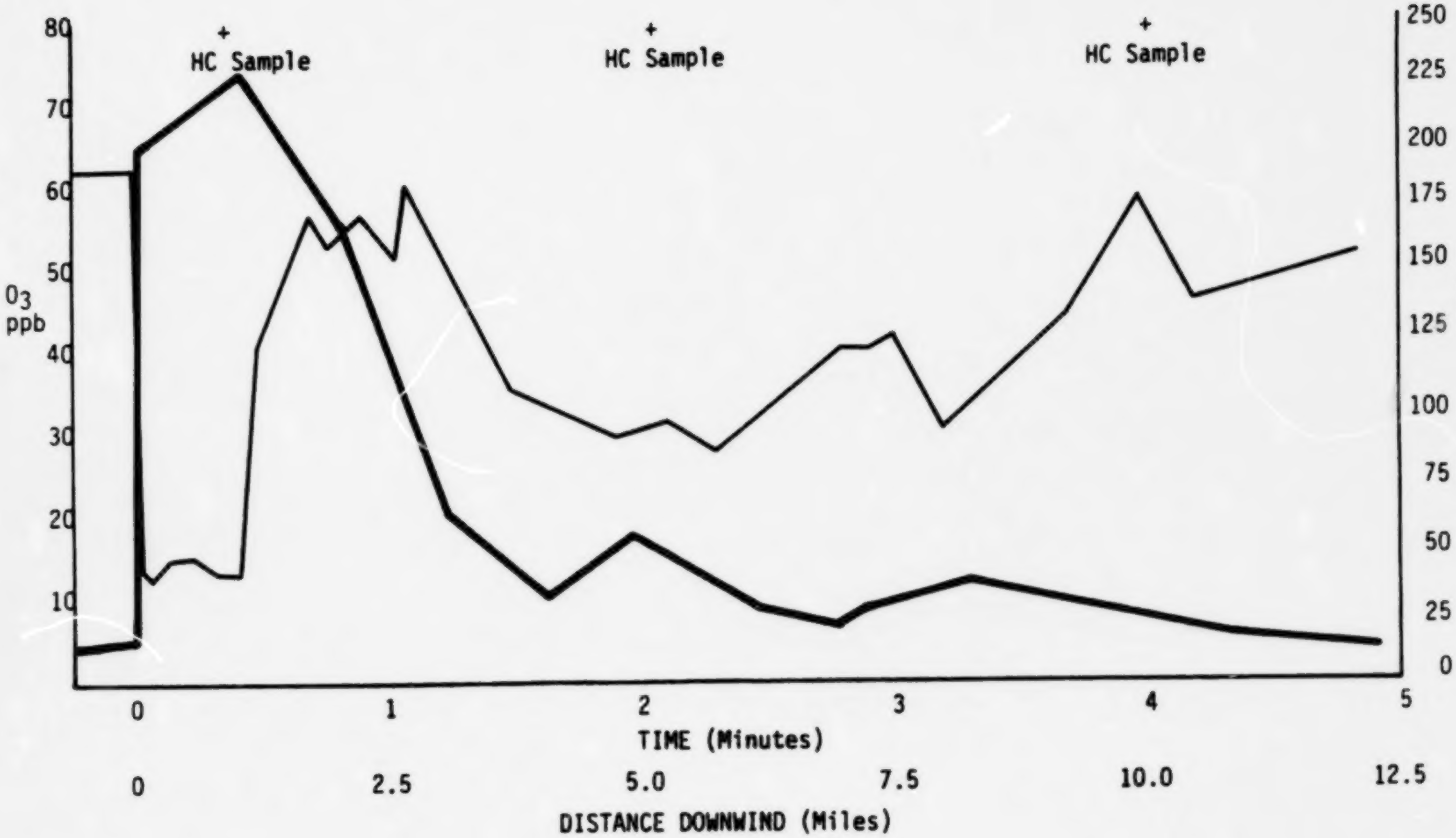

Figure 6. Ozone and SO_2 concentrations measured in the refinery plume on July 9, 1977.

Figure 6 also shows the approximate location of hydrocarbon grab samples collected within the plume at one, five and ten miles downwind, respectively. The results of individual hydrocarbon identification are presented in Table 3, along with a sample representative of ambient background air. It is readily evident from Table 3 that in-plume NMHC concentrations increase drastically over background levels at one and five miles. The sample taken at ten miles does not exhibit such pronounced differences, although elevated concentrations of n-butane, i-pentane, n-pentane and toluene are present. Dominant chemical species recorded during these aerial measurements correspond well with ground level monitoring near the refinery fenceline, with ethane, propane, i-butane, i-pentane, n-pentane and toluene predominating.

The instrumented aircraft transected the entire plume width at several points downwind of the refinery. Figures 7, 8, 9 and 10 display the variations on O_3 and SO_2 concentrations recorded during cross-plume traverses at 500 and 1000 ft. MSL at five and ten miles, respectively. In each instance, elevated SO_2 concentrations and O_3 depletion marked the location of marathon emissions. The reduced O_3 level observed undoubtedly results from the removal of O_3 by the excess nitric oxide often measured in the plume. The fact that O_3 depletion persisted out to ten miles is probably due to a lack of sufficient solar radiation at this hour of the morning to initiate substantial photochemical activity and limited mixing as a result of the low level temperature inversion.

July 21, 1977 (0630 - 0745 CDT)

The initial flight on July 21st was completed between 0630 - 0745 CDT. During this period prevailing winds carried the Marathon emissions to the northeast of the refinery. After a spiral to 14,000 ft. over Robinson, the instrumented aircraft made several passes through the area of plume drift, out to 12 miles from the plant.

O_3 and temperature variations with altitude as recorded during the vertical spiral at 0640 CDT are displayed in Figure 11. The data show a distinct temperature inversion with a corresponding drop in O_3 concentrations at approximately 1100 ft. MSL. Acoustical sounder tracings from the morning of the 21st (Appendix E) reveal a low level radiation inversion at about 150 ft. AGL from 0300 - 0600 with a gradual weakening

TABLE 3. Individual Hydrocarbon Concentrations (ppbC) Measured in Samples Collected on July 9, 1977.

HYDROCARBON	REPRESENTATIVE BACKGROUND	1 MILE FROM REFINERY AT 1500'	5 MILES FROM REFINERY AT 1500'	10 MILES FROM REFINERY AT 1500'
ethane	1.0	78.5	15.0	7.0
ethylene	0.5	36.0	*	*
acetylene	--	7.5	1.0	2.0
propane	5.0	128	38.0	17.0
propene	0.5	9.5	4.5	0.5
i-butane	1.5	23.5	10.5	3.0
n-butane	5.5	39.0	26.0	12.5
i-pentane	2.5	28.0	29.5	8.5
n-pentane	2.0	24.0	19.0	4.0
2-methylpentane	1.0	7.0	8.0	2.5
3-methylpentane	0.5	5.0	5.0	1.5
n-hexane	0.5	6.5	7.0	2.5
methylcyclopentane	0.5	4.0	4.5	1.5
benzene	1.0	3.0	3.0	2.0
toluene	2.0	10.0	10.0	4.0
ethylbenzene	0.5	2.0	2.0	1.0
p & m-xylene	1.0	5.0	5.0	3.0
o-xylene	0.5	2.0	2.0	1.0

-- <0.5 ppbC

* missing value

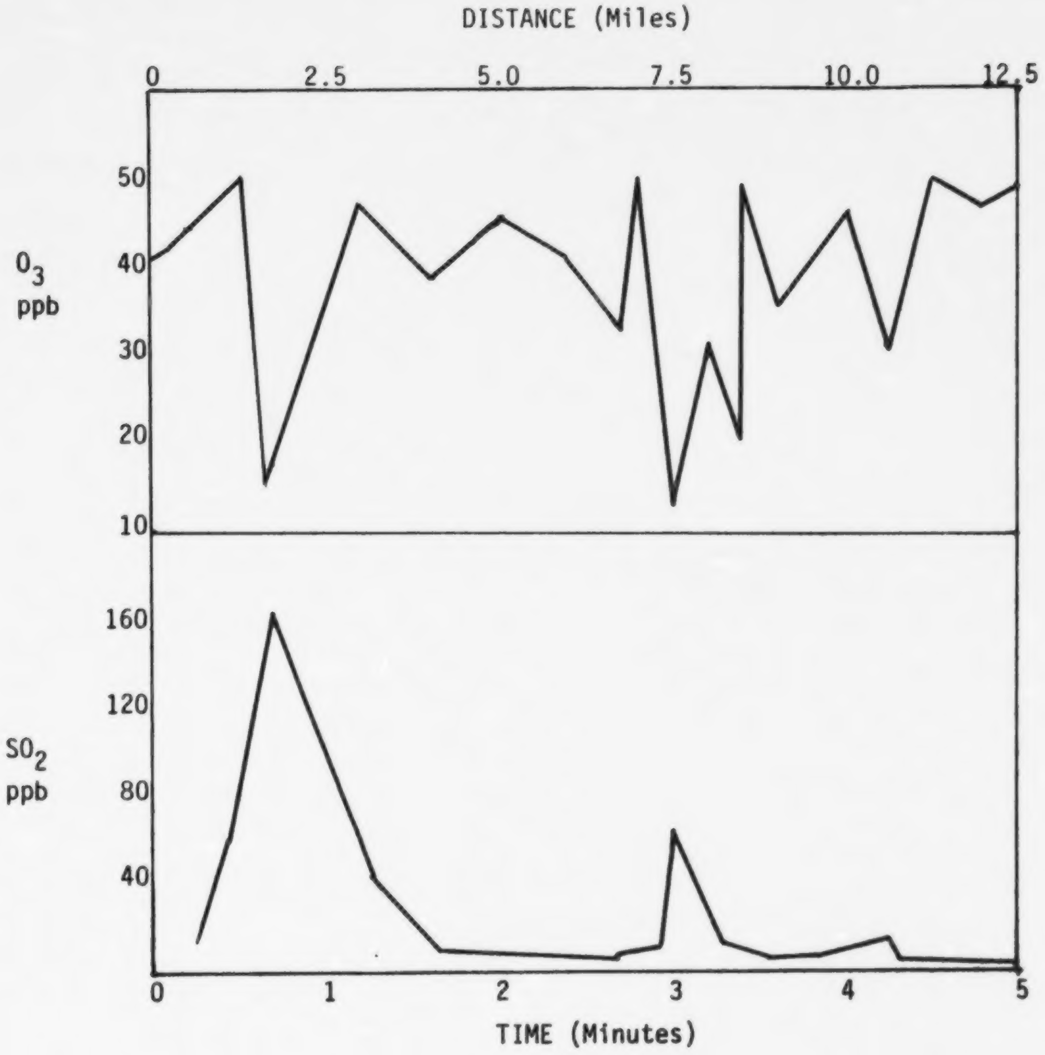

Figure 7. Ozone and SO_2 concentrations measured during a plume traverse at 500 ft. 5 miles from the refinery on July 9, 1977.

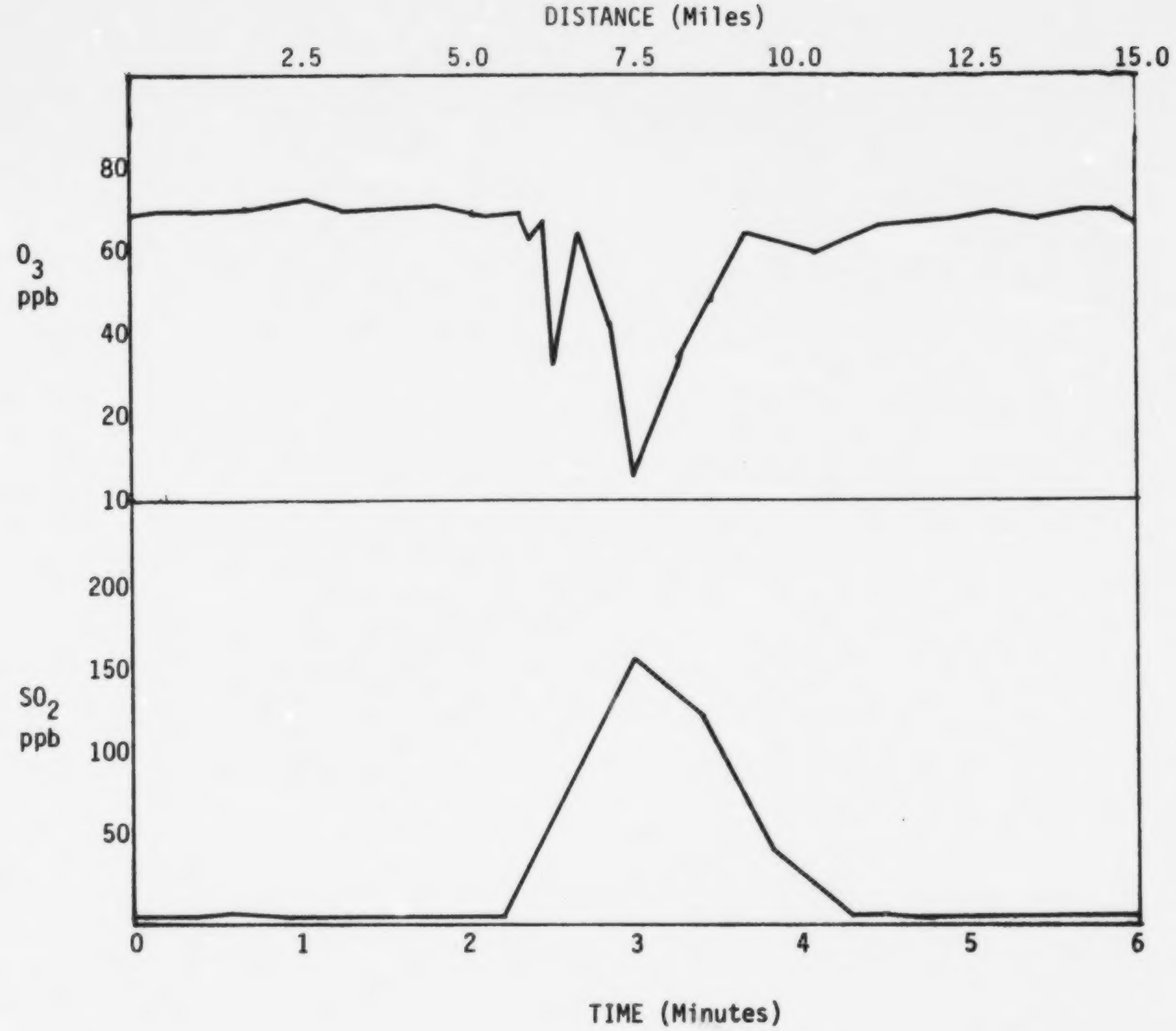

Figure 8. Ozone and SO_2 concentrations measured during a plume traverse at 1000 ft. 5 miles from the refinery on July 9, 1977.

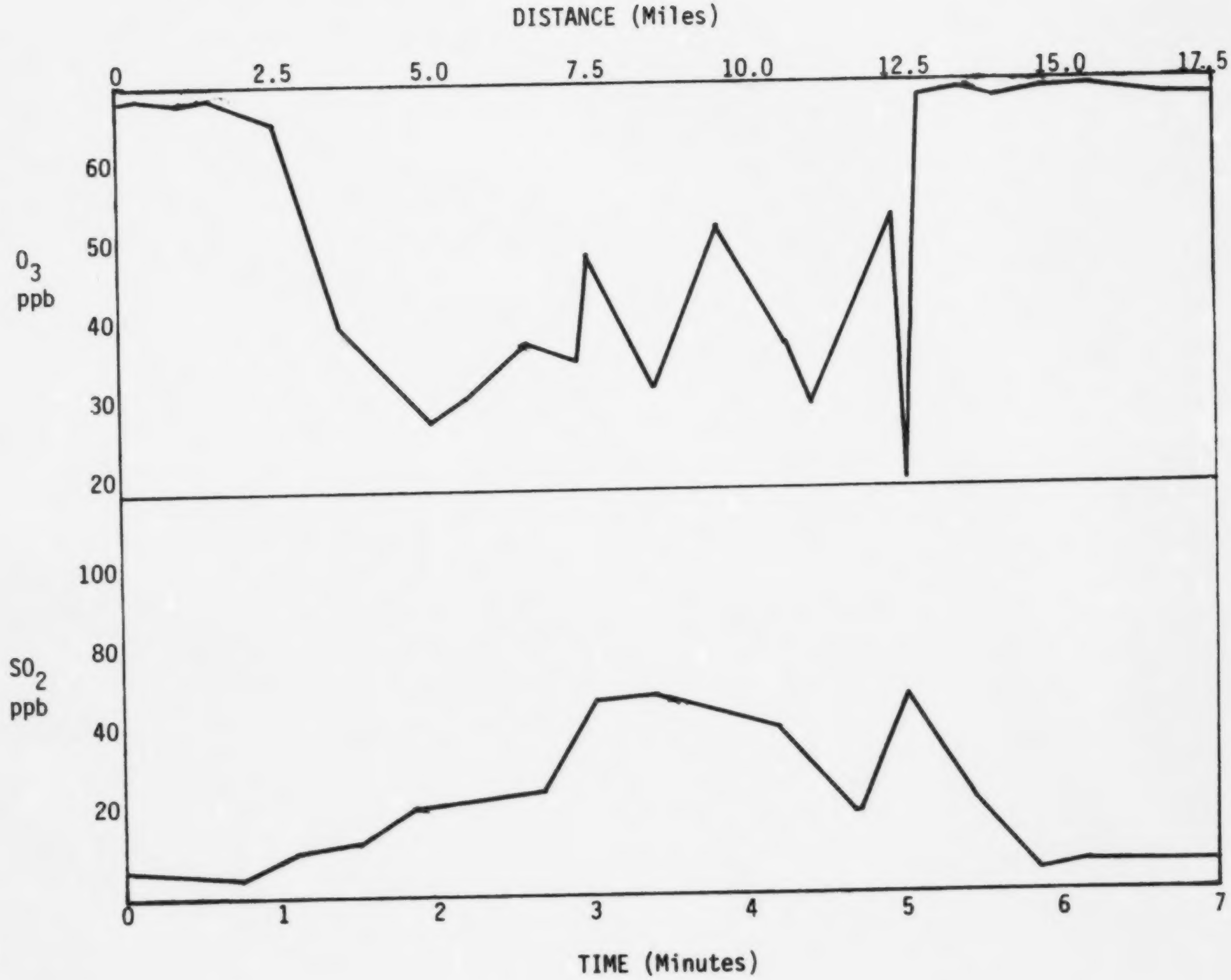

Figure 9. Ozone and SO_2 concentrations measured during a plume traverse at 500 ft. 10 miles from the refinery on July 9, 1977.

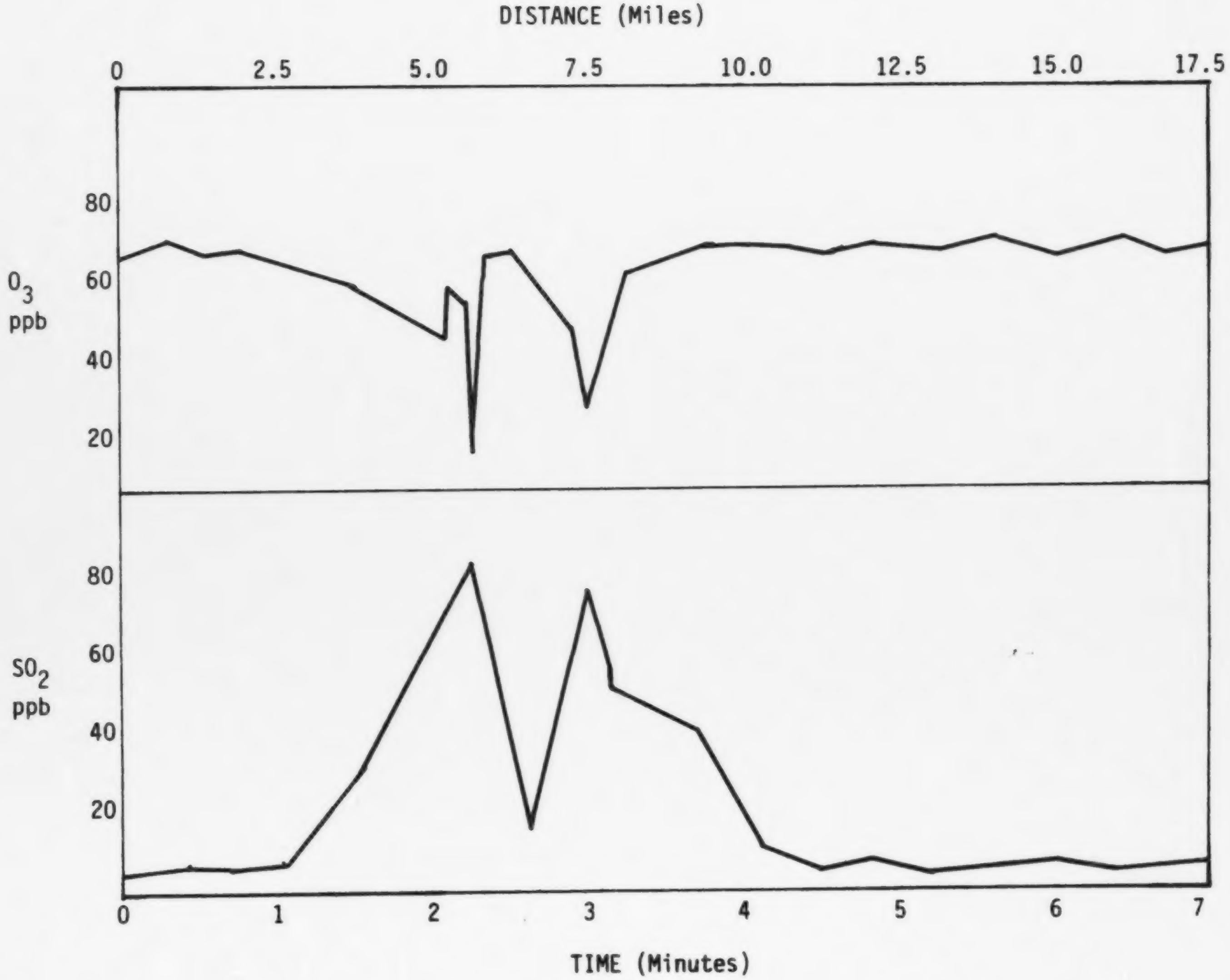

Figure 10. Ozone and SO_2 concentrations measured during a plume traverse at 1000ft. 10 miles from the refinery on July 9, 1977.

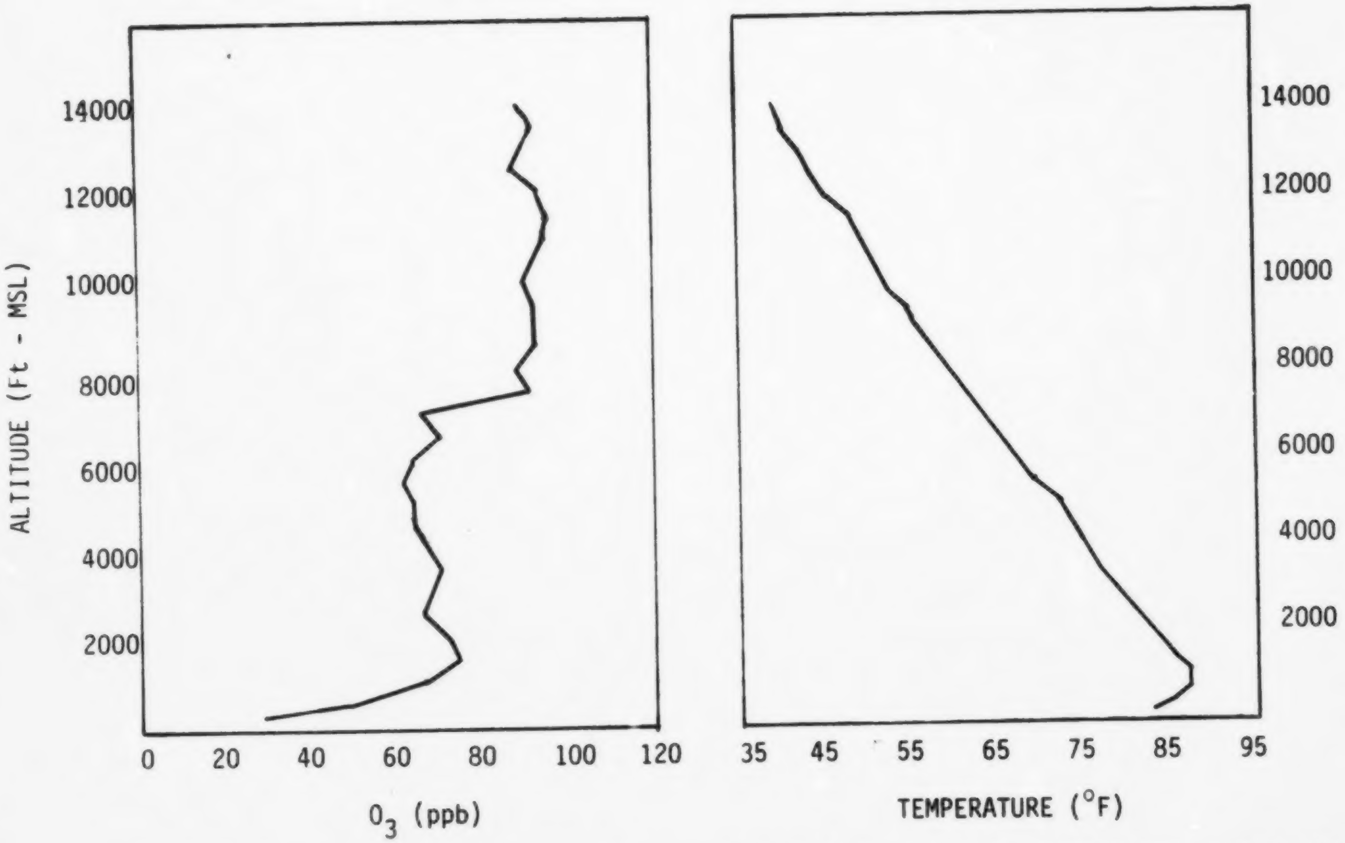

Figure 11. Ozone and temperature changes with altitude at about 0640 CDT on July 21, 1977.

and lifting of the temperature inversion between 0600 - 0930. By approximately 0700, the inversion had risen to 300 ft. MSL and by 0900, while considerably weaker, had raised to about 900 ft. MSL. Sounder records indicate a breakup of the inversion by 0930, with well mixed conditions prevailing up to at least 1500 ft. AGL.

Downwind of the refinery, the aircraft made a number of passes through the Marathon plume. Figure 12 shows the changes in O_3, SO_2 and CN measured during plume traverses at five and ten miles. It is clear that elevated SO_2 values increased over ambient background levels by approximately 100 ppb, five miles from the plant, while a 35 ppb in-plume increase was noted at ten miles. CN values on both passes showed a ten-fold increase over cleaner background levels. O_3 concentrations, on the other hand, exhibited marked depletion during both plume traverses. In-plume O_3 levels were below out-of-plume concentrations by approximately 35 ppb at five miles and 10 ppb at ten miles.

Hydrocarbon grab samples collected by the aircraft reveal elevated C_2-C_{10} molecular weight hydrocarbon levels in the refinery plume. Table 4 presents individual hydrocarbon concentrations for selected species taken at 14,000 ft. over Robinson and at 0-2 miles and 5-7 miles from the refinery complex. As expected, the sample at 14,000 ft. is extremely clean, containing less than 20 $\mu g/m^3$. The samples collected in the Marathon plume, however, both show elevated hydrocarbon levels. At 0-2 miles downwind of the refinery hydrocarbon values exceeded 1000 $\mu g/m^3$, while at 5-7 miles the total was greater than 200 $\mu g/m^3$. Saturated compounds were again the dominant species in plume samples.

July 21, 1977 (1005 - 1200 CDT)

In order to investigate the possibility of photochemical ozone production within the Marathon plume, a second flight was completed on July 21st from 1005 - 1200 CDT. Refinery emissions were again observed to the northeast of Robinson and plume boundaries were well defined at 16 miles downwind. Figure 13 displays the flight path and approximate location and dimensions of the Marathon effluent recorded on this flight.

Results of a vertical spiral to 9,000 ft. over Robinson at 1015 CDT are shown in Figure 14. Temperature data indicate the radiation inversion observed on the earlier flight has completely dissipated by 1015, thus

TABLE 4. Individual Hydrocarbon concentrations (ppbC) Measured in Samples Collected on July 21, 1977

HYDROCARBON	14000' PVER ROBINSON	0-2 MILES DOWNWIND OF REFINERY AT 1000'	5-7 MILES DOWNWIND OF REFINERY AT 1000'
ethane	3.0	149	27.5
ethylene	0.5	17.5	3.5
acetylene	1.0	1.5	1.0
propane	5.0	223	40.0
propene	0.5	44.0	3.5
i-butane	0.5	36.0	8.5
n-butane	1.5	81.0	20.0
i-pentane	2.5	75.0	19.5
n-pentane	0.5	57.0	12.0
2-methylpentane	---	25.0	6.0
3-methylpentane	---	12.5	3.5
n-hexane	---	33.5	6.0
methylcyclopentane	---	10.0	4.5
benzene	0.5	10.5	2.0
toluene	*	41.0	11.0
ethylbenzene	---	6.5	1.0
p & m-xylene	*	11.5	2.0
o-xylene	*	4.5	1.0

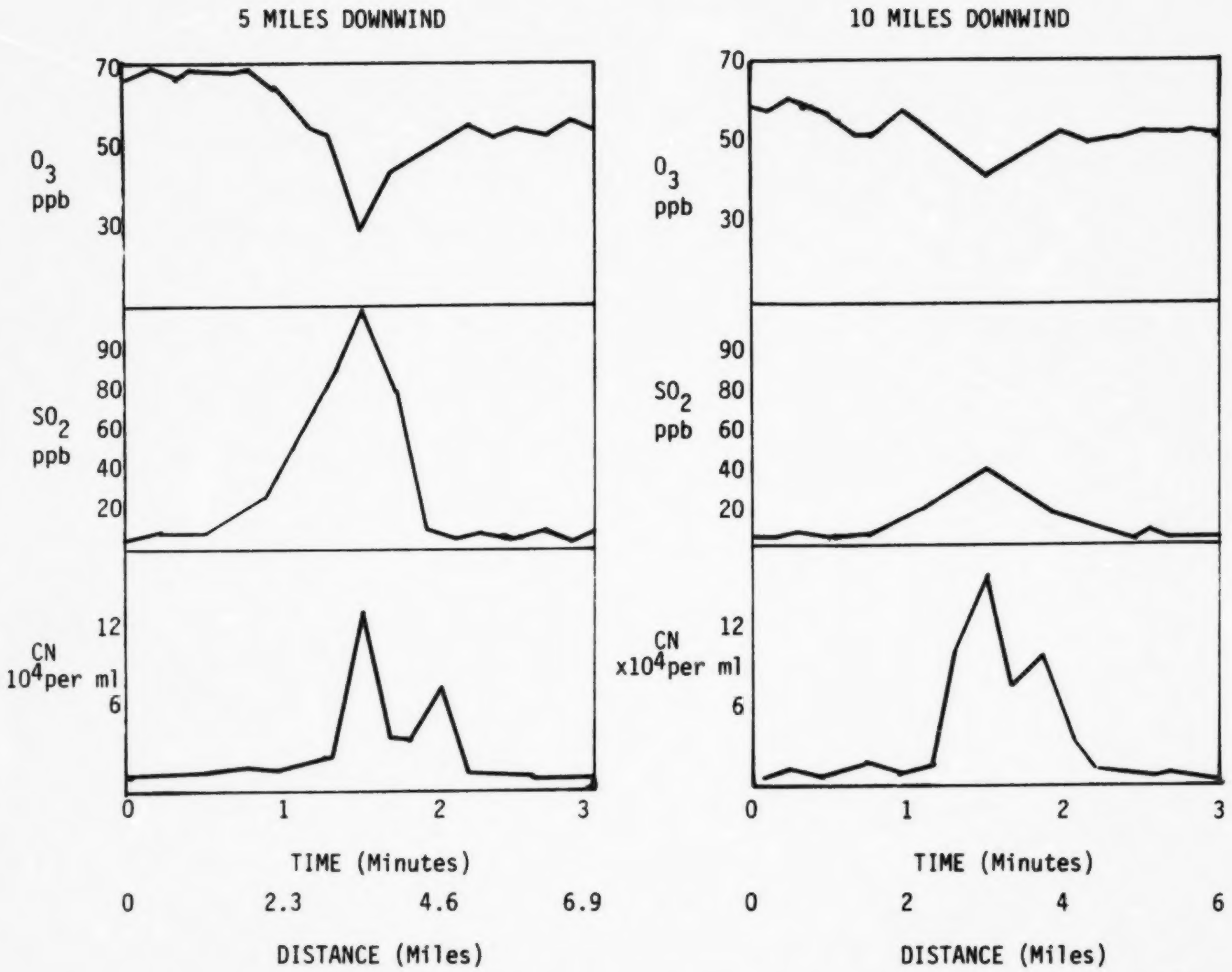

Figure 12. Ozone, SO_2 and CN concentrations measured during plume traverses at 5 and 10 miles from the refinery on July 21, 1977.

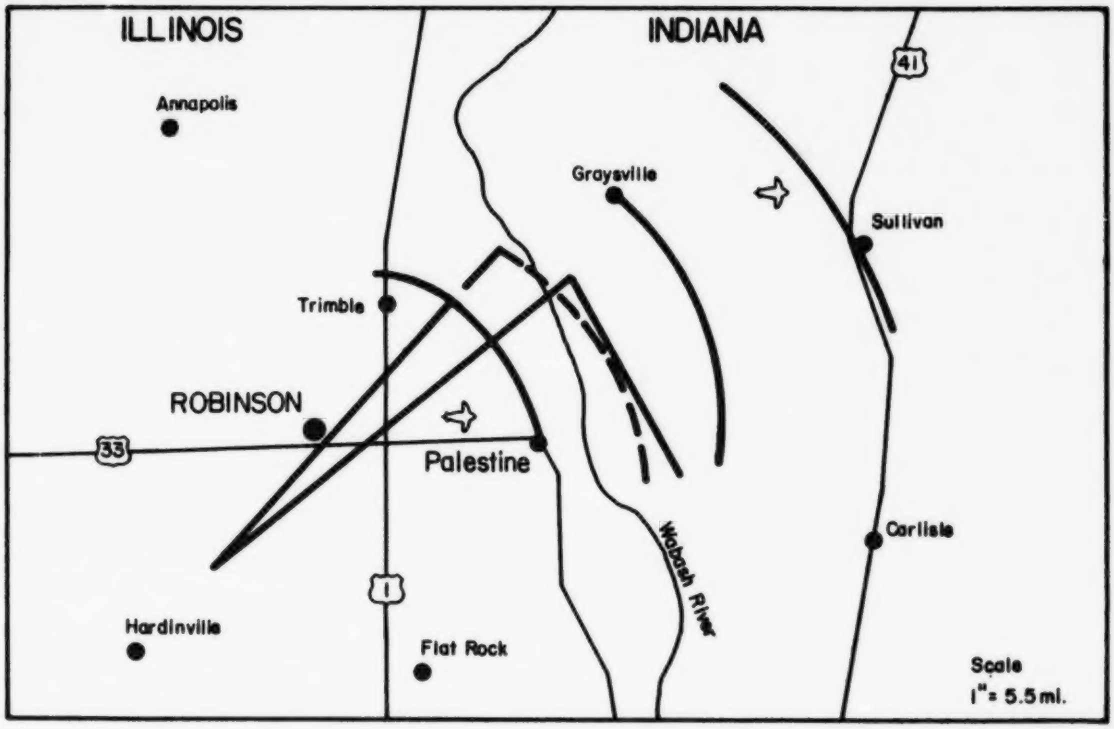
ILLINOIS
INDIANA
Annapolis
Graysville
Sullivan
41
Trimble
ROBINSON
33
Palestine
Wabash River
Carlisle
1
Hardinville
Flat Rock
Scale
1" = 5.5 mi.

Figure 13. Aircraft flight path and refinery plume location between 1000-1200 CDT on July 21, 1977.

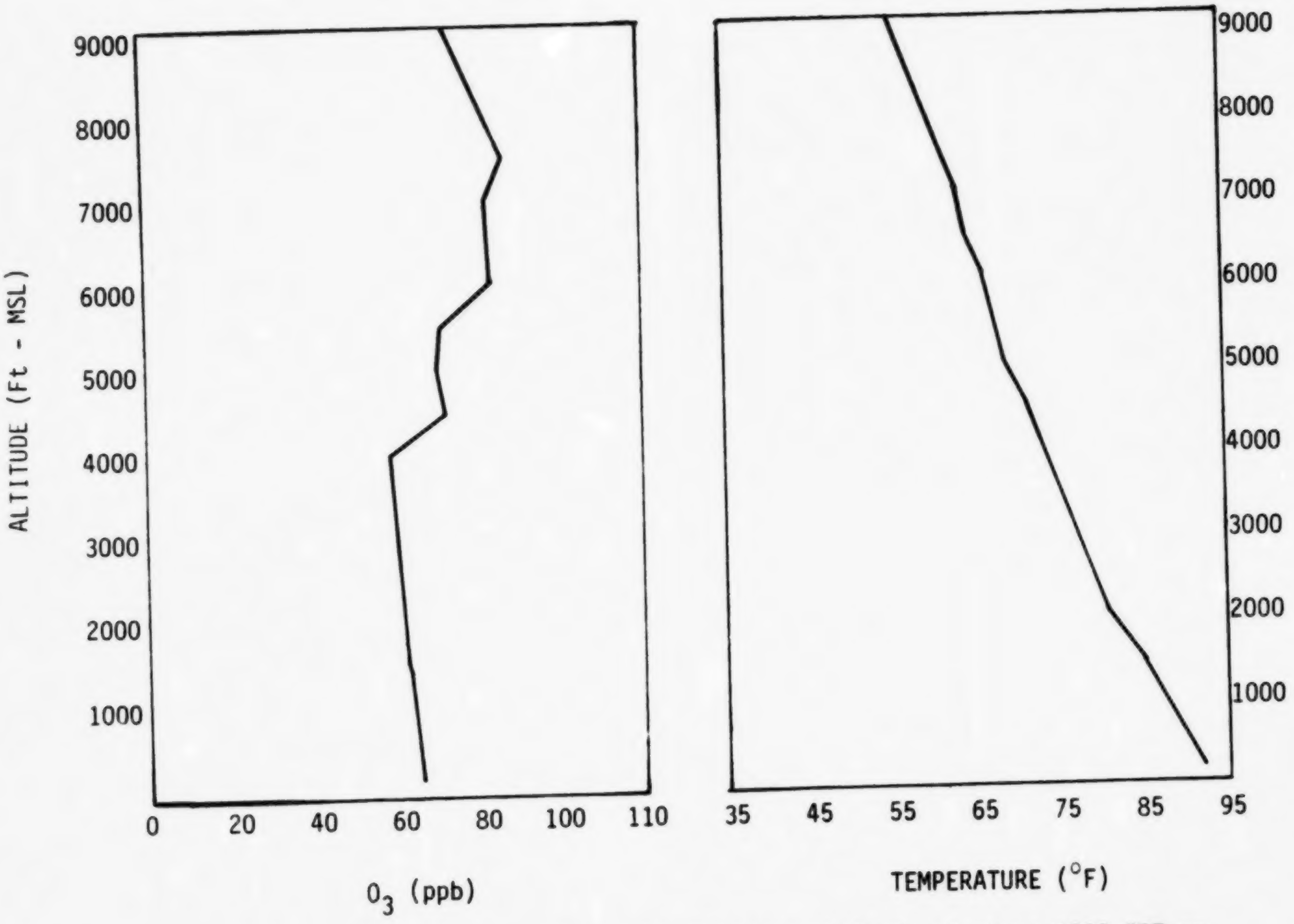

Figure 14. Ozone and temperature changes with altitude at about 1000 CDT on July 21, 1977.

confirming acoustical sounder tracings. O_3 concentrations are relatively constant up to 4000 ft. suggesting the mixing layer extended to at least that altitude. Measurements 12 miles from the refinery tend to corroborate these findings since Marathon emissions were detected at 3000 ft.

Cross-plume passes at 5, 8, 12 and 16 miles downwind of the refinery show the expected elevated SO_2 and CN concentrations which typically mark the Marathon emission boundaries. In addition, enhanced in-plume ozone concentrations were recorded in each instance. Figure 15, 16, 17 and 18 illustrate the fluctuation in O_3, SO_2, and CN measured by the aircraft as it transected the plume at 5, 8, 12 and 16 miles, respectively.

The buildup of ozone levels within the Marathon plume is portrayed in Table 5 as a function of distance downwind and altitude.

The plume traverses at 12 miles, illustrate the vertical stratification of refinery emissions downwind of the plant, with maximum ozone enhancement and plume width observed below 1000 ft. MSL. The Marathon effluent extends upward, however, to at least 2900 ft. MSL. Ozone buildup associated with emissions from the petroleum refinery was observed out to 16 miles from the plant.

TABLE 5. Ozone Buildup Within the Refinery Plume on July 21, 1977

Distance Downwind (miles)	Altitude (ft-MSL)	Plume Width (miles)	In-Plume O_3 (ppb) Buildup
5	1300	2.6	+7
8	1300	3	+8
12	900	5.5	+13
12	1900	3.5	+9
12	2900	2.9	+9
16	1300	3	+8

Table 6 lists individual hydrocarbon concentrations measured in background ambient air upwind of the refinery and a sample collected in the area of plume drift 12 miles downwind. In-plume values are obviously significantly above ambient levels outside of the plume.

TABLE 6 . Individual Hydrocarbon Concentrations (ppbC) Measured in Samples Collected on July 21, 1977

HYDROCARBON	1 MILE UPWIND OF REFINERY AT 1000'	12 MILES DOWNWIND OF REFINERY AT 1500'
ethane	10.0	9.5
ethylene	1.0	*
acetylene	1.0	1.0
propane	6.0	15.0
propene	0.5	0.5
i-butane	3.0	3.5
n-butane	9.5	10.0
i-pentane	3.0	7.5
n-pentane	3.5	4.5
2-methylpentane	1.0	2.0
3-methylpentane	0.5	1.0
n-hexane	1.5	2.5
methylcyclopentane	0.5	1.0
benzene	1.0	1.0
toluene	2.0	2.5
ethlybenzene	0.5	0.5
p & m-xylene	0.5	1.0
o-xylene	0.5	1.0

* missing value

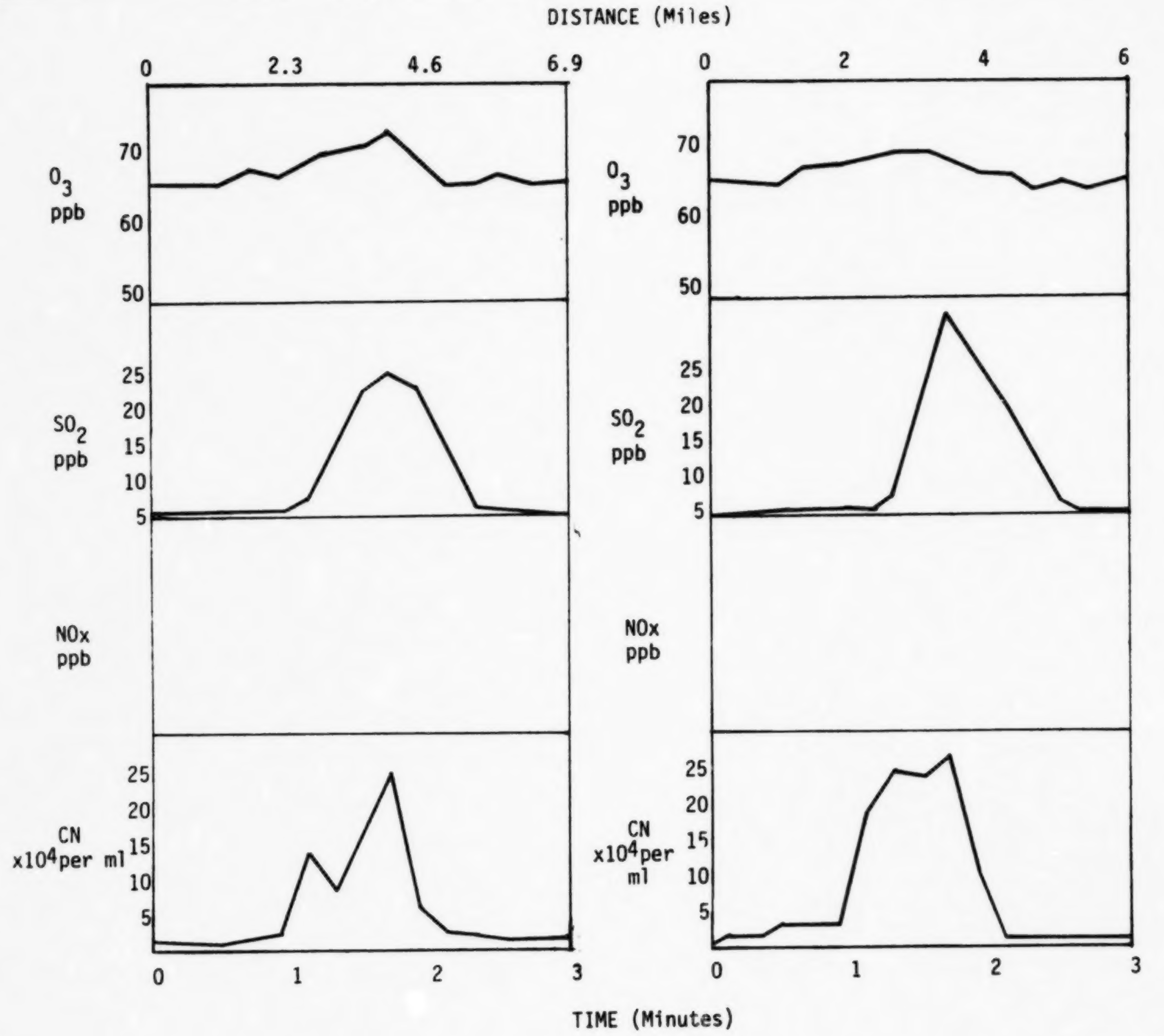

Figure 15. Ozone, SO_2 and CN concentrations measured during a plume traverse at 1300 ft. 5 miles from the refinery on July 21, 1981.

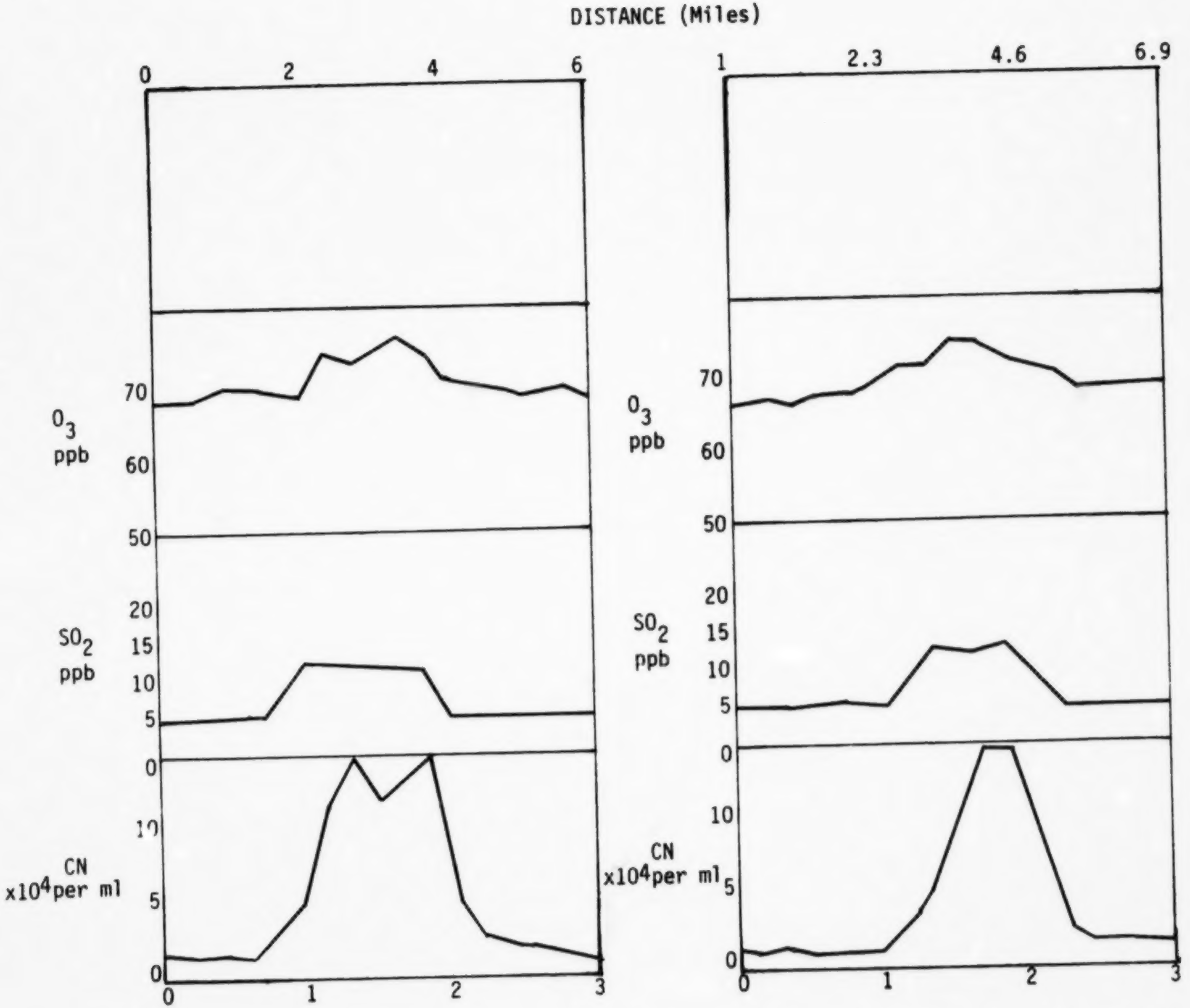

Figure 16. Ozone, SO_2 and CN concentrations measured during a plume traverse at 1300 ft. 8 miles from the refinery on July 21, 1977.

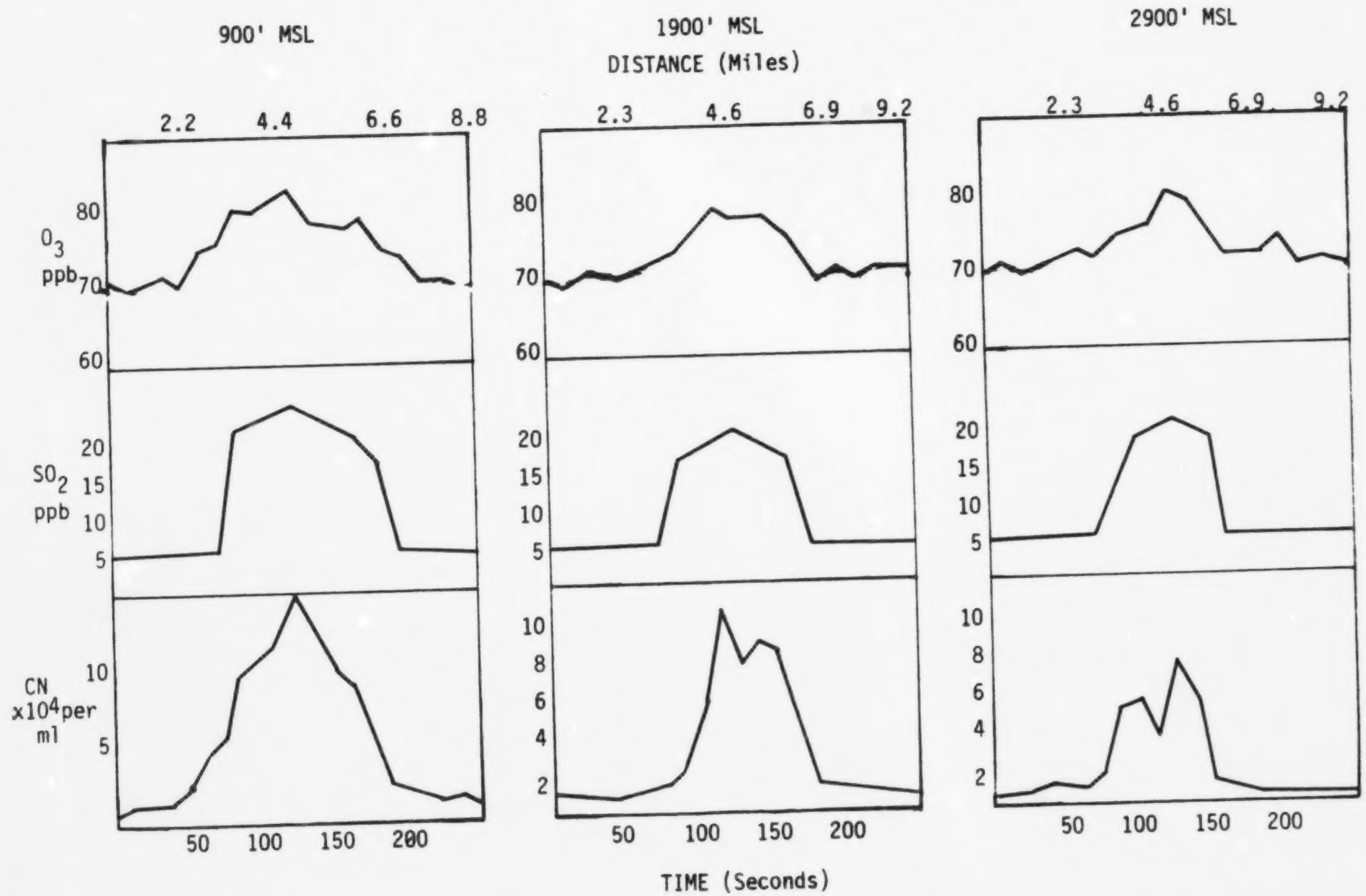

Figure 17. Ozone, SO_2 and CN concentrations measured during a plume traverse 12 miles from the refinery on July 21, 1977.

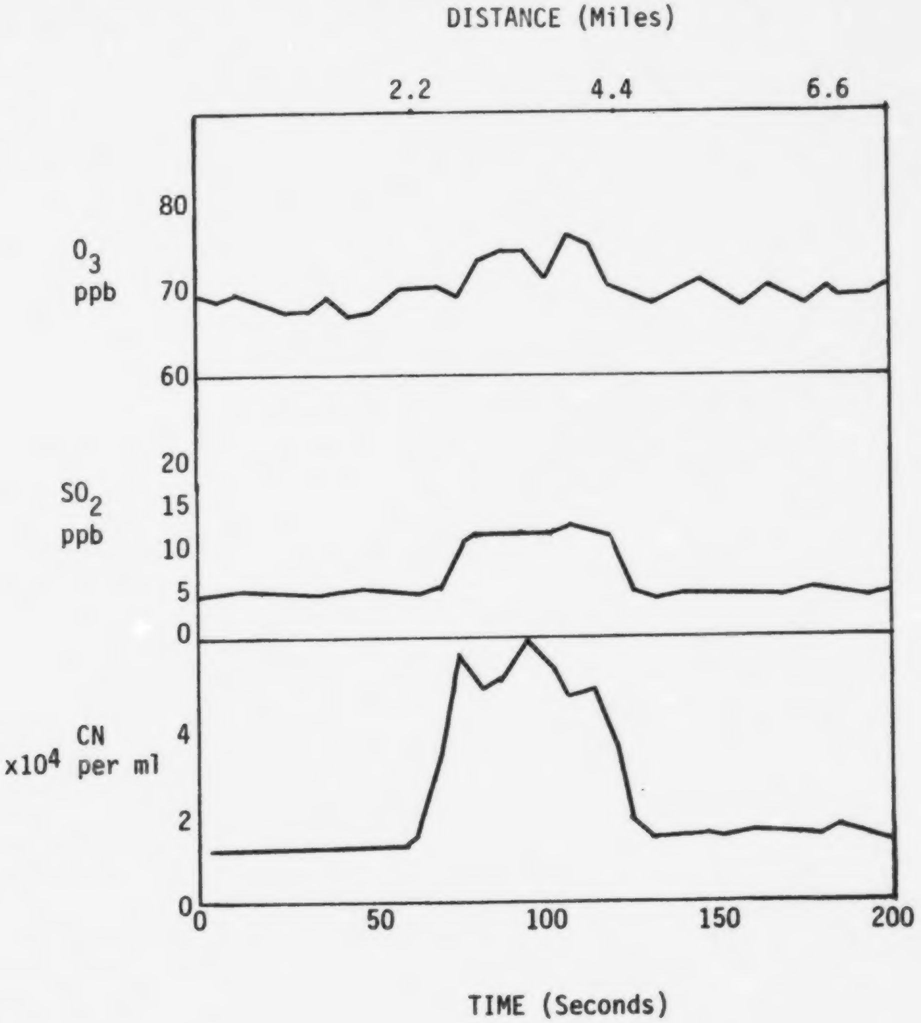

Figure 18. Ozone, SO_2 and CN concentrations measured during a plume traverse 16 miles from the refinery on July 21, 1977.

July 8, 1977

Aerial measurements on July 8th from 1045 - 1415 CDT revealed a rather unique dispersion pattern for Marathon emissions. The refinery effluent was observed to the north of the plant, but O_3, SO_2 and CN data indicated a bimodal distribution of pollutants across a wide area. The data indicate two separate in-plume maxima for O_3, SO_2 and CN, with one "plume" carried to the northeast and the other "plume" to the northwest. The flight path and approximate location and dimensions recorded for the refinery emission are portrayed in Figure 19.

Figures 20, 21, and 22 illustrate O_3, SO_2, NO_x and CN concentrations recorded during plume traverses at 5, 10 and 15 miles downwind, respectively. Distances given in these figures are not straight line distances between two points, but mileage along downwind arcs of the refinery complex (see Figure 19). Thus plume widths and distances between peak values in Figures 20, 21 and 22 are greater than if the aircraft had transected the area of plume drift on a straight line perpendicular to the prevailing wind direction (southerly).

Data from cross-plume passes portrayed in Figures 20, 21 and 22 show that maximum in-plume ozone enhancement was on the order of 30 ppb at 5, 10 and 15 miles. This increase represents the greatest ozone buildup observed in the Marathon plume during the 1977 field study. While ambient background levels outside of the refinery emission boundaries were between 85-90 ppb, peak in-plume concentrations were 115-120 ppb. Highest SO_2 (25-30 ppb) and CN values were also recorded in the area of maximum ozone production.

At 15 miles from the refinery, the aircraft made three traverses of the "plume" to the northeast of the plant at 2500, 3500 and 4500 ft. MSL, respectively. Marathon emissions were clearly defined by increased O_3, SO_2 and CN values at each altitude. Figure 23 displays the results of O_3, SO_2, NO_x and CN measurements during these plume traverses.

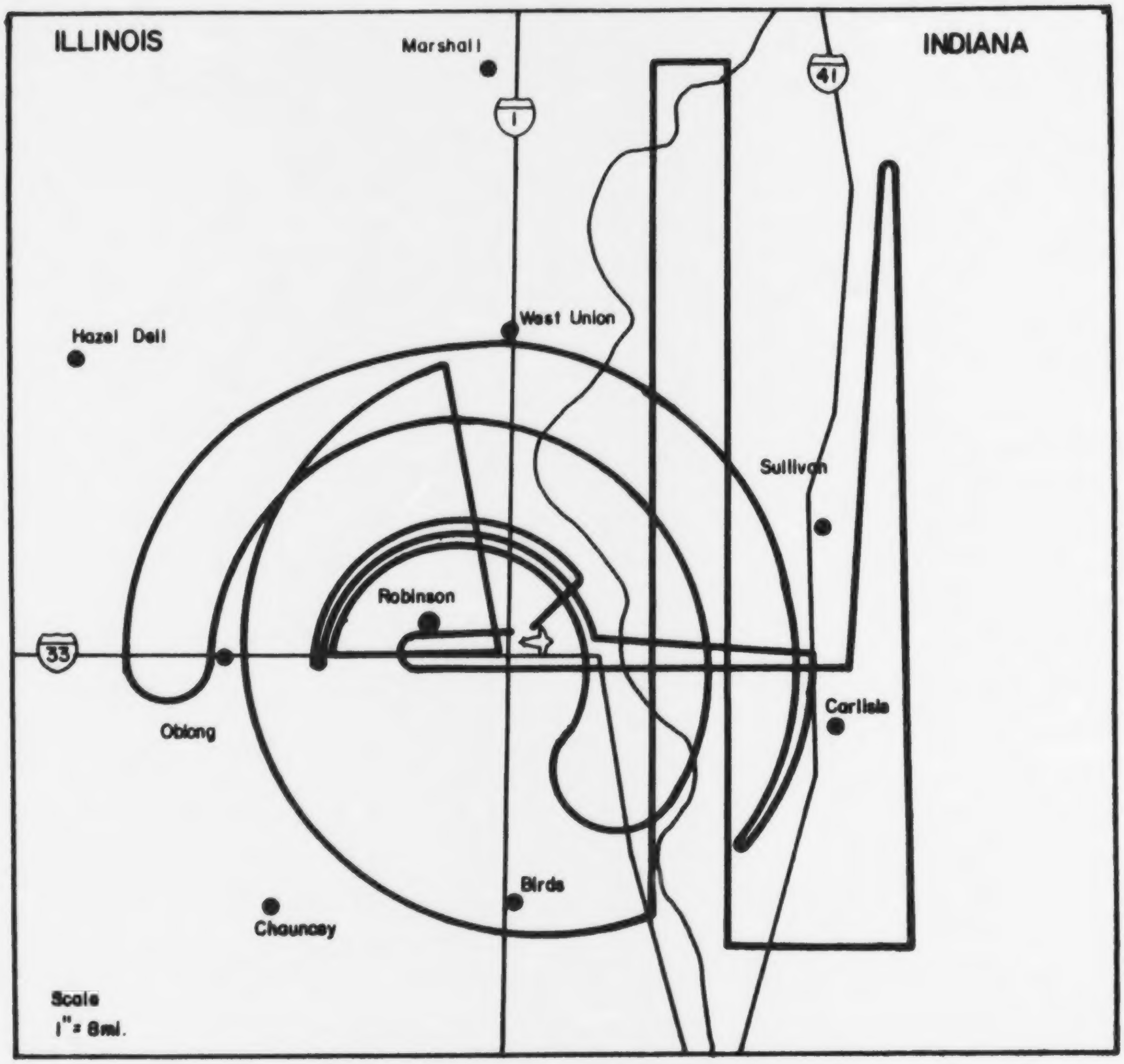
ILLINOIS
INDIANA
Marshall
1
41
West Union
Hazel Dell
Sullivan
Robinson
33
Carlisle
Oblong
Birds
Chauncey
Scale
1" = 8mi.

Figure 19. Aircraft flight path between 1045-1415 CDT on July 8, 1977.

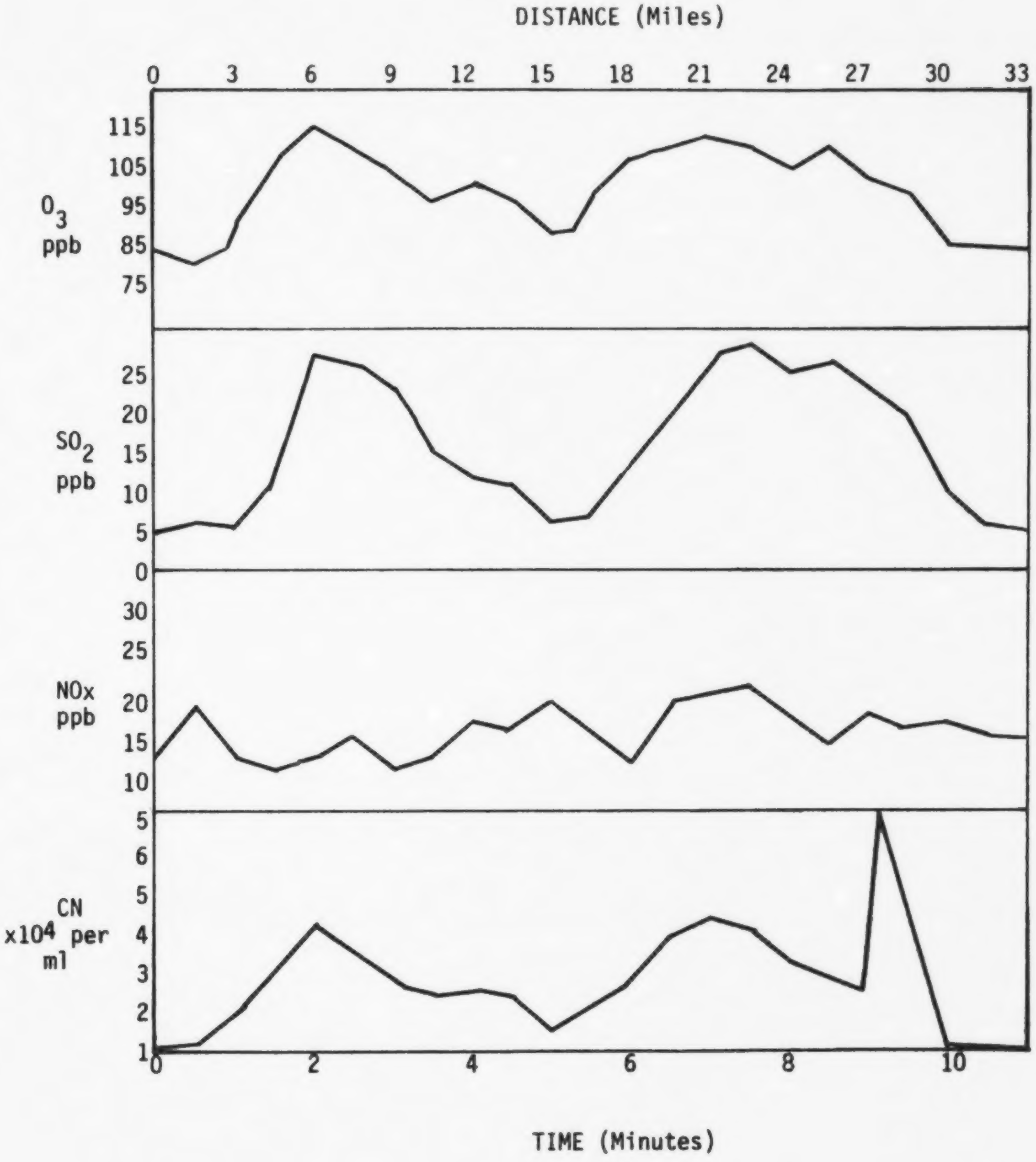

Figure 20. Ozone, SO_2, NOx and CN concentrations recorded during a plume traverse 5 miles from the refinery on July 8, 1977.

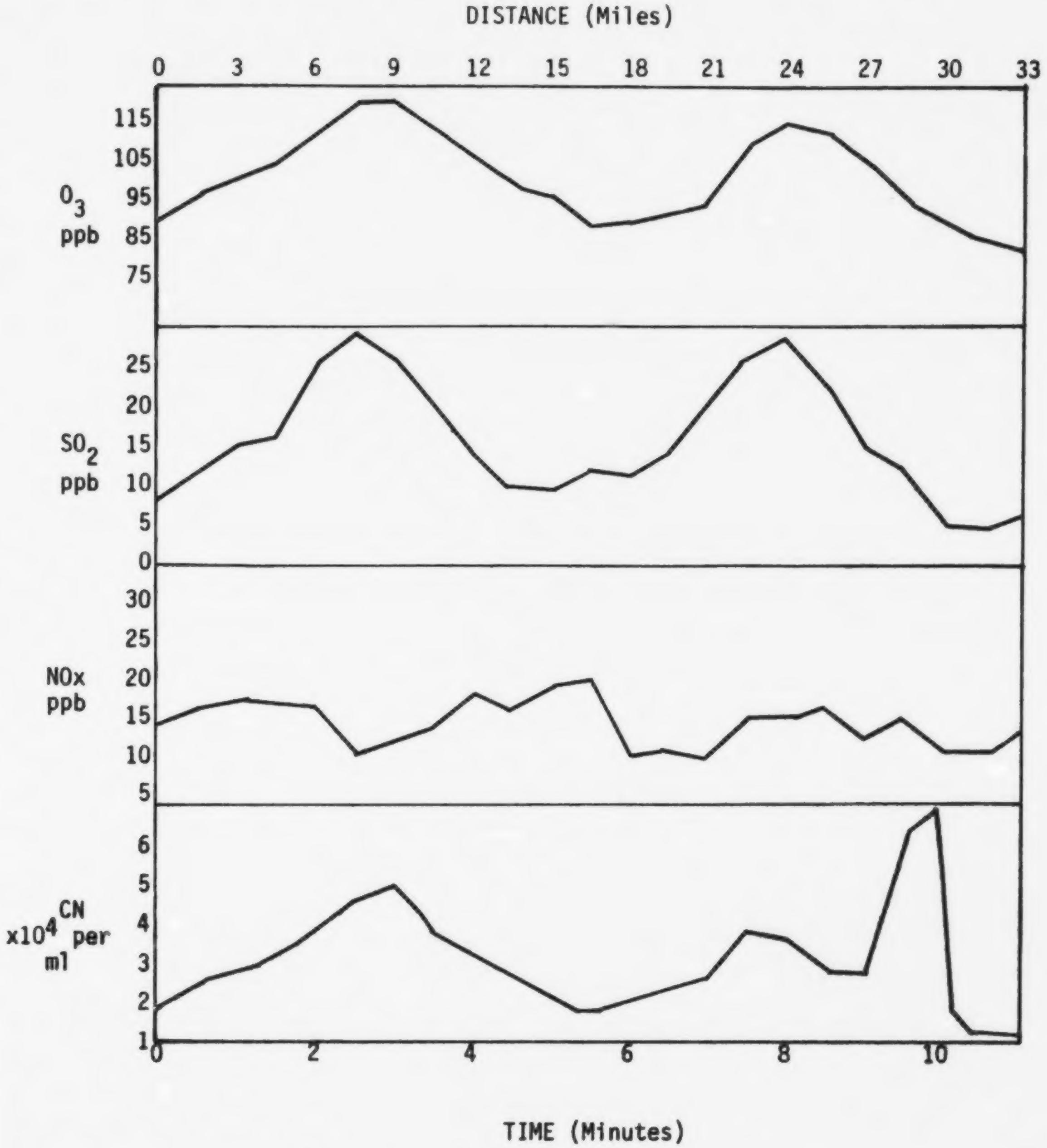

Figure 21. Ozone, SO_2, NOx and CN concentrations recorded during a plume traverse 10 miles from the refinery on July 8, 1977.

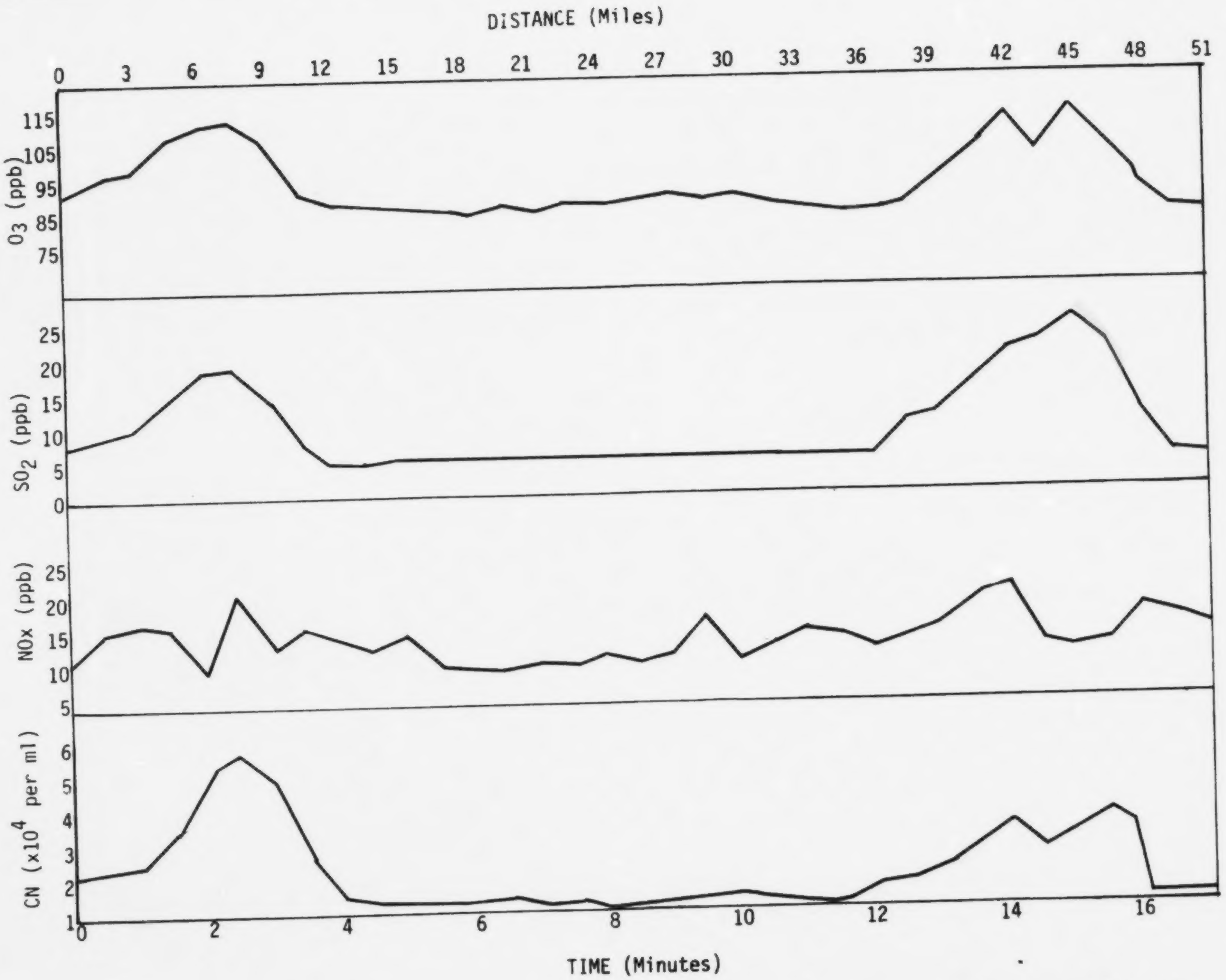

Figure 22. Ozone, SO_2, NOx and CN concentrations recorded during a plume traverse 15 miles from the refinery on July 8, 1977.

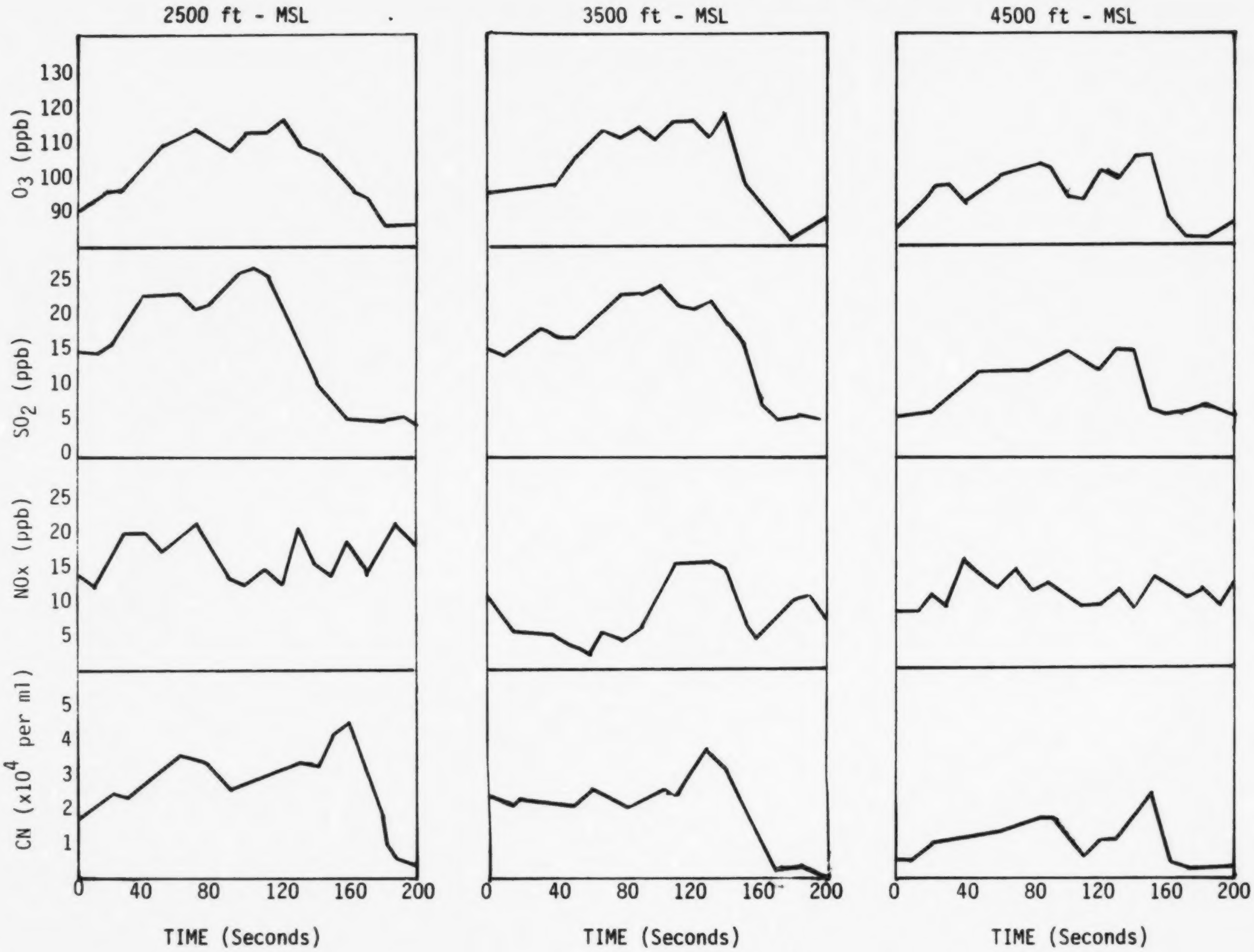

Figure 23. Ozone, SO_2, NOx and CN concentrations recorded at three different altitudes in the refinery plume. Measurements were 15 miles from the refinery on July 8, 1977.

SECTION 5

CONCLUSIONS

Natural sunlight irradiations of captured refinery emissions suggest maximum in-plume ozone formation could exceed background by approximately 150 ppb, and by as much as 400 ppb in samples spiked with additional NO_x. Ozone production in the bags was observed to vary with changes in $NMHC/NO_x$ ratios (optimum between 10 and 20) and initial hydrocarbon concentrations (approximately a linear relationship). Aerial measurements downwind of the refinery detected elevated ozone levels within plume boundaries on two of six flights conducted during meteorological conditions favoring photochemical ozone production. Peak in-plume ozone values exceeded background by 15-30 ppb, a ten-fold decrease from maximum levels recorded for captive air irradiations.

Two questions arise from a comparison of irradiation and ambient data. Why was ozone enhancement in the Marathon plume not observed on two-thirds of the flights when it might reasonably have been expected? Why were peak in-plume ozone concentrations as measured by the aircraft less by a factor of ten than ozone production measured during the irradiation experiments?

Because of the complexities associated with meteorological variables and atmospheric photochemical processes there is no shortage of plausible explanations for the lack of ozone buildup in the Marathon plume on four of six flights. Plume dispersion is a function of many factors, including wind speed and direction, turbulence, mixing depth and insolation. Photochemical reactions proceed only if adequate UV radiation, temperature and precursor concentrations are available to sustain oxidant formation. Therefore, in order for excess photochemical ozone to be produced in the refinery plume a number of conditions must be met: 1) sufficient UV radiation and temperature; 2) most of the NO_x, initially emitted as NO, must be converted to NO_2; 3) dilution of NMHC and NO_x due to plume dispersion must not be so great as to preclude adequate concentrations for photochemical reactions; 4) favorable NMHC/NO_x ratios must be present; and 5) minimum irradiation time for ozone production is required.

The most likely explanation for the failure of aircraft measurements to detect in-plume ozone enhancement on days with adequate UV radiation and temperature lies in the variation between meteorological parameters from day to day. Although all six flights occurred between 1000 - 1600 CDT, differences in mixing height, turbulence, wind speed and stability classification undoubtedly contributed significantly to an absence of ozone buildup on some flights. Considering the number of factors which must be present simultaneously to give rise to photochemical ozone formation within Marathon plume boundaries it is somewhat surprising that this phenomenon was observed at all.

Since in-plume ozone enhancement was measured on two flights, it is important to consider why values were less by a factor of ten than peak levels for irradiation experiments. As shown by cross-plume traverses downwind of the refinery, pollutant concentrations gradually decrease due to the dilution as plume dispersion increases with distance. The importance of NMHC/NO_x ratios and absolute hydrocarbon levels for photochemical ozone production has already been discussed and atmospheric dispersion can have a substantial impact on both parameters.

From the data presented earlier, it is clear that NMHC and NO_x concentrations were much higher in irradiation samples collected at ground level near the refinery than in aerial samples downwind. Captive irradiation bags contained NMHC levels as high as 6600 ppbC, while values measured at 300-500 meters above the surface at 8 km from the plant typically ranged from 300-400 ppbC and from 100-150 ppbC at 16 km. As noted previously, the amount of ozone formed varies directly with NMHC levels. For example, at a constant NMHC/NO_x of 16, ozone production in the Teflon chambers increased from 70 ppb in a background sample ($100 < \text{NMHC} < 180$) to 150 ppb in a plume sample containing 300-500 ppbC NMHC to 415 ppb for an emissions sample with 1100-1300 ppbC. Thus the recorded in-plume ozone enhancement downwind of the Marathon refinery is consistent with captive air irradiation since NMHC values were greatly diluted in the areas of ozone buildup.

SECTION 6

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APPENDIX A

This section presents hourly averages for pollutant concentrations and meteorological parameters measured at the WSU field laboratory. Data are given in tabular form for recorded values of O_3, NO, NO_2, NMTHC, CO, CH_4, CH_3CCl_3, wind speed, wind direction, gustiness (and indicator of turbulence intensity), temperature, and solar radiation.

TABLE A1 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-17-77

	GAS	DATA								MET.	DATA					
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
0200	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
0300	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
0400	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	30.00
0500	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
0600	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
0700	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
0800	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	30.03
0900	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
1000	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
1100	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
1200	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	30.01
1300	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
1400	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
1500	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	----
1600	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	29.92
1700	73	11	--	--	--	--	--	--	--	10	085	19	89	31	823	----
1800	75	11	--	--	--	--	--	--	--	11	118	16	88	30	630	----
1900	65	11	--	--	--	--	--	--	--	10	116	20	87	29	778	----
2000	60	12	--	--	--	--	--	--	--	8	131	17	84	25	0	29.91
2100	55	12	--	--	--	--	--	--	--	7	122	20	81	20	0	----
2200	--	--	--	--	--	--	--	--	--	--	---	--	--	--	0	----
2300	37	19	--	--	--	--	--	--	--	8	114	17	76	17	0	----
2400	33	23	--	--	--	--	--	--	--	6	105	17	75	16	0	29.94

TABLE A2 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-18-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	24	28	--	--	--	--	--	--	--	7	090	9	74	15	0	----
0200	21	30	--	--	--	--	--	--	--	4	099	12	73	14	0	----
0300	21	33	--	--	--	--	--	--	--	3	116	18	72	14	0	----
0400	21	33	--	--	--	--	--	--	--	3	129	16	72	13	0	29.92
0500	22	28	--	--	--	--	--	--	--	4	122	20	72	14	0	----
0600	20	26	--	--	--	--	--	--	--	3	104	16	72	14	0	----
0700	20	25	--	--	--	--	--	--	--	4	124	18	73	15	119	----
0800	22	22	--	--	--	--	--	--	--	5	139	14	76	16	314	29.92
0900	27	18	--	--	--	--	--	--	--	6	140	17	79	18	540	----
1000	36	15	--	--	--	--	--	--	--	11	150	12	81	22	699	----
1100	44	5	--	--	--	--	--	--	--	9	145	18	84	26	863	----
1200	52	4	--	--	--	--	--	--	--	10	157	16	87	29	966	29.92
1300	55	3	--	--	--	--	--	--	--	13	162	12	88	30	929	----
1400	57	3	--	--	--	--	--	--	--	14	175	13	86	30	689	----
1500	60	2	--	--	--	--	--	--	--	18	235	7	82	22	215	----
1600	62	2	--	--	--	--	--	--	--	15	221	8	85	24	704	29.91
1700	59	12	--	--	--	--	--	--	--	18	224	7	87	29	876	----
1800	60	16	--	--	--	--	--	--	--	16	228	8	87	29	635	----
1900	55	13	--	--	--	--	--	--	--	14	220	7	86	28	374	----
2000	48	12	--	--	--	--	--	--	--	9	213	6	83	25	176	29.92
2100	30	15	--	--	--	--	--	--	--	6	183	4	79	21	0	----
2200	26	14	--	--	--	--	--	--	--	6	209	5	76	16	0	----
2300	17	16	--	--	--	--	--	--	--	4	193	3	73	14	0	----
2400	18	14	--	--	--	--	--	--	--	3	169	5	72	13	0	29.98

TABLE A3 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-19-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	14	18	25	--	--	--	--	--	--	1	120	8	70	11	0	--
0200	8	18	33	--	--	--	--	--	--	2	115	6	68	9	0	--
0300	4	16	24	--	--	--	--	--	--	2	092	5	67	8	0	--
0400	5	15	26	--	--	--	--	--	--	2	143	12	65	8	0	29.98
0500	2	21	26	--	--	--	--	--	--	1	217	8	65	8	0	--
0600	10	22	23	--	--	--	--	--	--	3	095	18	65	8	0	--
0700	15	9	8	--	--	--	--	--	--	4	068	10	68	10	111	--
0800	17	10	14	--	--	--	--	--	--	3	129	12	71	12	194	30.01
0900	19	11	16	--	--	--	--	--	--	3	231	10	73	12	185	--
1000	23	14	15	--	--	--	--	--	--	7	157	12	74	14	360	--
1100	32	12	9	--	--	--	--	--	--	8	165	10	77	17	455	--
1200	36	10	15	--	--	--	--	--	--	6	156	19	79	35	624	29.98
1300	41	7	6	--	--	--	--	--	--	5	097	22	80	67	590	--
1400	26	7	10	--	--	--	--	--	--	2	031	8	72	59	892	--
1500	55	10	6	--	--	--	--	--	--	8	138	15	81	66	434	--
1600	48	13	9	--	--	--	--	--	--	10	125	14	79	67	329	29.94
1700	43	9	9	--	--	--	--	--	--	3	195	15	78	69	307	--
1800	41	9	16	--	--	--	--	--	--	4	176	16	80	68	410	--
1900	39	11	10	--	--	--	--	--	--	8	159	10	80	67	371	--
2000	36	11	11	--	--	--	--	--	--	6	153	8	79	64	157	29.90
2100	29	13	15	--	--	--	--	--	--	5	149	8	77	65	0	--
2200	27	10	16	--	--	--	--	--	--	4	157	9	77	65	0	--
2300	31	8	13	--	--	--	--	--	--	6	158	6	75	64	0	--
2400	25	8	16	--	--	--	--	--	--	4	180	6	72	64	0	29.94

TABLE A4 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-20-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	14	9	27	--	--	--	--	--	--	3	171	5	72	64	0	--
0200	14	12	22	--	--	--	--	--	--	2	108	7	68	63	0	--
0300	15	8	8	--	--	--	--	--	--	3	062	13	67	62	0	--
0400	12	8	17	--	--	--	--	--	--	3	192	10	66	61	0	29.93
0500	10	8	20	--	--	--	--	--	--	2	195	9	67	61	0	--
0600	5	18	39	--	--	--	--	--	--	1	129	6	66	61	0	--
0700	4	33	39	--	--	--	--	--	--	2	172	9	67	62	72	--
0800	9	18	28	--	--	--	--	--	--	4	133	13	71	65	133	29.96
0900	15	14	26	--	--	--	--	--	--	5	168	14	77	66	168	--
1000	28	12	18	--	--	--	--	--	--	8	175	14	81	66	175	--
1100	35	9	9	--	--	--	--	--	--	10	194	11	84	66	194	--
1200	42	6	5	--	--	--	--	--	--	11	200	13	86	65	200	29.95
1300	44	9	6	--	--	--	--	--	--	13	184	12	88	62	184	--
1400	43	9	3	--	--	--	--	--	--	15	206	14	88	61	206	--
1500	54	8	--	--	--	--	--	--	--	19	216	11	90	59	216	--
1600	76	9	--	--	--	--	--	--	--	20	229	9	89	56	228	29.91
1700	73	8	--	--	--	--	--	--	--	18	216	10	90	54	215	--
1800	73	9	--	--	--	--	--	--	--	17	215	9	89	52	215	--
1900	73	8	--	--	--	--	--	--	--	16	244	5	88	52	242	--
2000	70	8	--	--	--	--	--	--	--	13	240	2	85	52	239	29.95
2100	66	9	--	--	--	--	--	--	--	9	244	5	81	53	0	--
2200	61	9	--	--	--	--	--	--	--	8	247	5	77	51	0	--
2300	52	8	--	--	--	--	--	--	--	4	256	9	74	49	0	--
2400	39	10	--	--	--	--	--	--	--	5	251	7	72	48	0	30.04

TABLE A5 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-21-77

	GAS			DATA						MET.		DATA				
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	39	11	7	--	--	---	--	--	--	6	272	8	69	49	0	--
0200	42	9	8	.1	1.5	1.6	--	--	--	6	286	6	66	51	0	--
0300	43	9	7	.1	.7	1.7	--	--	--	4	253	9	65	51	0	--
0400	28	10	8	.1	.7	1.7	--	--	--	4	239	8	62	50	0	30.09
0500	13	10	14	.1	.7	1.7	--	--	--	3	232	5	9[illegible]	49	0	--
0600	14	14	19	.2	.8	1.7	--	--	--	1	202	11	59	50	0	--
0700	17	18	27	.1	.8	1.7	--	--	--	2	260	8	60	50	110	--
0800	24	12	12	.2	.8	1.7	--	--	--	3	278	10	62	51	289	30.17
0900	34	10	5	.2	.7	1.7	--	--	--	7	317	12	66	52	597	--
1000	38	8	2	.1	.6	1.7	--	--	--	7	324	14	70	53	856	--
1100	43	9	--	.1	.6	1.7	--	--	--	9	323	14	72	53	904	--
1200	49	5	--	.2	.6	1.7	--	--	--	9	314	18	74	52	1124	30.17
1300	54	6	--	.3	.6	1.7	--	--	--	9	314	18	76	52	1113	--
1400	56	9	--	<.1	.6	1.7	--	--	--	11	337	16	78	51	907	--
1500	62	9	6	<.1	.6	1.7	--	--	--	10	267	19	80	51	1121	--
1600	78	13	17	<.1	.6	1.7	--	--	--	9	188	15	80	51	624	30.0
1700	73	3	1	<.1	.6	1.7	--	--	--	7	092	11	79	52	261	--
1800	65	--	1	<.1	.6	1.7	--	--	--	5	233	8	77	52	69	--
1900	36	1	1	<.1	.6	1.7	--	--	--	6	092	5	74	54	26	--
2000	29	1	1	<.1	.6	1.7	--	--	--	5	350	7	73	53	22	30.09
2100	27	1	1	<.1	.6	1.7	--	--	--	3	017	8	71	54	0	--
2200	33	1	1	<.1	.6	1.7	--	--	--	4	102	7	71	55	0	--
2300	46	1	1	<.1	.6	1.7	--	--	--	8	014	6	71	55	0	--
2400	46	1	1	<.1	.6	1.7	--	--	--	7	131	10	70	55	0	30.10

TABLE A 6 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-22-77

				GAS	DATA							MET.	DATA			
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	39	1	1	<.1	.6	1.7	--	--	--	5	288	15	67	57	0	--
0200	42	1	1	<.1	.6	1.7	--	--	--	6	161	12	64	57	0	--
0300	45	1	1	<.1	.6	1.7	--	--	--	11	010	9	63	60	0	--
0400	48	1	1	<.1	.6	1.7	--	--	--	14	022	8	63	60	0	30.08
0500	51	1	1	--	--	---	--	--	--	13	022	8	63	59	0	--
0600	46	1	1	.1	.6	1.6	--	--	--	14	032	9	63	59	0	--
0700	44	1	1	--	--	---	--	--	--	10	033	11	64	59	68	--
0800	44	1	1	.1	.5	1.6	--	--	--	9	287	10	64	60	84	30.05
0900	43	1	1	<.1	.6	1.7	--	--	--	8	345	9	65	60	131	--
1000	43	1	1	<.1	.6	1.7	--	--	--	7	351	10	65	58	200	--
1100	46	1	1	<.1	.6	1.7	--	--	--	9	347	10	66	59	245	--
1200	45	1	1	.1	.6	1.7	--	--	--	9	344	10	67	59	209	30.09
1300	48	1	2	.1	.6	1.7	--	--	--	9	340	10	67	59	197	--
1400	47	6	4	.1	.6	1.7	--	--	--	9	346	11	67	59	213	--
1500	49	6	1	.1	.7	1.7	--	--	--	8	346	10	67	59	178	--
1600	49	5	2	.1	.8	1.7	--	--	--	8	347	10	67	59	132	30.06
1700	44	5	3	.1	.7	1.7	--	--	--	7	353	10	67	59	64	--
1800	41	5	3	.1	.7	1.7	--	--	--	6	328	8	67	59	37	--
1900	38	5	4	--	--	---	--	--	--	7	324	8	66	58	24	--
2000	35	4	3	--	--	---	--	--	--	8	324	7	66	58	22	30.08
2100	34	4	3	--	--	---	--	--	--	8	340	10	65	58	0	--
2200	30	4	5	--	--	---	--	--	--	5	254	9	65	58	0	--
2300	29	3	4	--	--	---	--	--	--	5	340	9	66	58	0	--
2400	24	4	3	--	--	---	--	--	--	3	332	7	64	58	0	30.12

TABLE A7 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-23-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	22	4	3	2	1.7	2.0	--	--	--	3	320	6	65	58	0	--
0200	22	3	4	---	---	---	--	--	--	4	317	7	65	58	0	--
0300	21	4	4	---	---	---	--	--	--	4	336	9	66	58	0	--
0400	16	5	7	---	---	---	--	--	--	5	267	11	66	58	0	30.12
0500	14	9	9	---	---	---	--	--	--	5	099	11	66	59	0	--
0600	16	10	6	---	---	---	--	--	--	7	047	14	67	59	0	--
0700	7	9	30	---	---	---	--	--	--	6	149	20	64	56	414	--
0800	--	--	--	---	---	---	--	--	--	-	---	--	--	--	---	30.15
0900	--	--	--	---	---	---	--	--	--	-	---	--	--	--	---	--
1000	--	--	--	3.3	3.1	1.7	231	245	279	-	---	--	--	--	---	--
1100	--	--	--	<.1	.8	1.7	238	245	264	-	---	--	--	--	---	--
1200	--	--	--	.1	.8	1.7	217	250	283	-	---	--	--	--	---	30.13
1300	41	8	6	.5	.8	1.7	208	280	295	5	076	18	77	67	903	--
1400	61	6	6	<.1	.9	1.7	183			4	067	19	80	69	803	--
1500	78	5	5	.1	.9	1.7	213	270	248	2	076	19	81	69	535	--
1600	70	4	5	.3	.8	1.7	206	269	280	7	239	10	78	69	254	30.09
1700	59	5	4	<.1	.8	1.7	194	278	289	7	263	12	77	70	489	--
1800	58	10	5	<.1	.8	1.7	192	291	223	4	209	14	78	70	332	--
1900	57	5	4	<.1	.7	1.7	210	249	173	8	203	7	77	67	169	--
2000	44	6	9	<.1	.7	1.7	228	268	172	3	168	11	76	67	80	30.08
2100	35	7	9	<.1	.8	1.7	193	248	186	3	084	8	75	67	0	--
2200	25	8	8	.1	.8	1.7	190	271	197	3	067	7	74	67	0	--
2300	26	6	4	<.1	.7	1.8	190	270	200	3	081	12	73	67	0	--
2400	28	5	5	<.1	.8	1.8	254	258	165	3	074	10	73	67	0	30.07

TABLE A8 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-24-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	27	4	5	.4	1.1	1.8	161	156	227	2	088	12	73	68	0	--
0200	27	4	2	.1	1.1	1.8	165	119	171	3	099	17	73	67	0	--
0300	26	3	2	< .1	1.1	1.7	159	145	138	4	113	15	72	67	0	--
0400	24	3	2	< .1	1.1	1.7	145	162	153	5	109	13	72	69	0	30.04
0500	21	3	1	< .1	1.1	1.7	148	115	134	5	105	14	72	69	0	--
0600	19	5	2	< .1	1.1	1.7	147	127	161	7	139	10	72	68	0	--
0700	15	7	4	< .1	1.0	1.7	150	142	155	6	147	9	72	70	38	--
0800	17	6	4	< .1	1.0	1.7	145	108	142	8	150	9	72	70	48	30.08
0900	12	11	6	< .1	.9	1.7	154	129	144	3	130	14	72	70	87	--
1000	12	11	5	< .1	1.0	1.7	145	131	121	3	097	17	72	69	128	--
1100	15	12	5	< .1	1.0	1.7	---	---	---	6	125	12	74	70	273	--
1200	23	9	5	< .1	1.1	1.7	148	136	128	9	161	10	75	67	246	30.07
1300	23	9	6	< .1	1.0	1.7	141	125	145	7	169	12	77	68	368	--
1400	33	5	4	< .1	1.0	1.7	171	138	171	7	203	11	79	70	642	--
1500	39	7	5	< .1	1.0	1.7	159	128	160	10	186	11	80	70	493	--
1600	47	5	3	< .1	1.0	1.7	147	124	120	5	215	14	82	71	676	30.04
1700	47	6	6	.1	.9	1.6	147	126	141	7	177	14	84	71	695	--
1800	46	7	7	< .1	.9	1.6	148	136	118	7	160	10	83	70	194	--
1900	34	7	4	< .1	.9	1.6	165	150	158	12	169	10	77	67	75	--
2000	33	5	4	< .1	.9	1.6	164	108	145	15	161	10	75	67	96	29.94
2100	28	6	4	< .1	.8	1.6	161	108	172	7	157	10	73	64	0	--
2200	24	5	3	< .1	.9	1.6	154	110	147	4	141	11	73	64	0	--
2300	22	6	4	< .1	1.0	1.7	154	110	203	3	094	14	72	65	0	--
2400	21	5	2	< .1	1.0	1.7	145	114	140	4	117	13	72	65	0	29.96

TABLE A9 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-25-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	20	4	2	< .1	.6	1.7	139	99	--	5	111	12	72	66	0	--
0200	21	4	2	< .1	.6	1.6	156	130	--	7	113	12	73	66	0	--
0300	21	3	2	< .1	.6	1.7	156	129	--	5	164	15	73	68	0	--
0400	17	3	3	< .1	.7	1.7	158	127	--	7	144	11	72	69	0	29.93
0500	14	4	3	< .1	.6	1.7	152	103	--	7	179	10	72	69	0	--
0600	10	5	6	< .1	.6	1.7	152	126	--	8	171	9	73	69	0	--
0700	11	5	4	< .1	.7	1.7	145	109	--	7	126	10	72	70	67	--
0800	11	7	2	< .1	.6	1.6	143	119	--	10	143	10	73	68	154	29.95
0900	14	7	3	< .1	.6	1.6	143	130	--	11	158	11	75	67	468	--
1000	18	10	3	3.1	.8	1.9	134	139	--	12	160	11	78	67	668	--
1100	23	11	6	1.1	.6	1.9	148	129	--	12	173	11	80	69	741	--
1200	28	9	5	.1	.6	1.5	143	126	--	14	179	11	81	69	744	29.95
1300	35	7	4	.1	--	1.8	145	158	--	13	175	12	83	70	1057	--
1400	38	6	3	---	--	---	155	124	--	8	169	14	84	70	801	--
1500	38	6	3	---	--	---	150	130	--	8	175	12	83	70	600	--
1600	--	--	--	---	--	---	152	148	--	--	---	--	--	--	---	29.88
1700	--	--	--	---	--	---	150	111	--	--	---	--	--	--	---	--
1800	39	19	15	---	--	---	149	133	--	5	157	14	--	--	426	--
1900	--	35	--	---	--	---	155	133	--	--	---	21	--	--	340	--
2000	--	--	--	---	--	---	135	133	--	--	---	--	--	--	---	29.87
2100	39	10	--	---	--	---	193	125	--	2	123	15	--	--	0	--
2200	22	7	7	---	--	---	167	140	--	3	163	10	78	69	0	--
2300	21	10	9	---	--	---	162	145	--	3	189	13	76	68	0	--
2400	21	4	4	---	--	---	158	136	--	4	089	9	75	68	0	29.92

TABLE A10 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-26-77

	GAS			DATA						MET.		DATA					
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	13	7	8	--	--	---	177	137	133	4	139	9	74	67	0	--
0200	16	4	4	--	--	---	174	134	139	3	190	12	74	68	0	--
0300	9	4	5	--	--	---	169	148	146	1	229	12	73	67	0	--
0400	12	3	3	--	--	---	181	139	136	4	273	9	72	67	0	29.90
0500	17	3	2	--	--	---	171	127	126	4	273	5	72	66	0	--
0600	16	3	2	--	--	---	161	123	139	3	265	6	70	64	0	--
0700	15	3	2	--	--	---	173	116	136	3	289	6	71	65	141	--
0800	22	4	2	--	--	---	170	119	195	6	319	9	73	66	374	29.96
0900	29	5	3	.1	.7	1.7		---	---	7	345	13	77	67	685	--
1000	38	4	2	.2	.7	1.6	184	141	138	7	177	17	80	69	906	--
1100	47	5	1	.2	.7	1.6	152	120	155	9	017	13	82	69	1111	--
1200	49	3	-	.3	.6	1.5	164	138	171	8	012	21	84	67	1224	29.95
1300	58	4	2	.4	.6	1.6	170	128	179	6	034	16	86	67	1326	--
1400	63	5	1	.4	.7	1.6	154	140	144	6	193	23	87	67	1118	--
1500	64	4	2	.2	.7	1.6	186	146	159	9	262	16	87	68	877	--
1600	63	4	1	.2	.7	1.6	167	134	159	9	348	10	86	67	492	29.92
1700	60	4	2	.2	.7	1.6	174	139	172	8	261	10	86	67	276	--
1800	53	5	5	.2	.8	1.6	158	130	129	5	071	12	81	67	122	--
1900	41	8	4	.3	.7	1.6	170	129	143	2	206	9	78	70	77	--
2000	32	6	7	.2	.8	1.6	189	155	155	2	211	10	79	71	59	29.90
2100	16	9	11	.2	1.0	1.7	171	148	148	2	052	10	79	71	0	--
2200	21	9	7	.3	.8	1.7	157	152	150	3	049	11	78	70	0	--
2300	29	7	5	.3	.7	1.7	158	170	113	4	079	12	77	70	0	--
2400	40	3	2	.2	.6	1.6	162	129	118	5	074	12	75	67	0	29.90

TABLE A11 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-27-77

	GAS	DATA								MET.	DATA					
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	34	3	2	.3	.6	1.6	161	135	114	3	065	11	74	67	0	--
0200	32	3	2	.2	.6	1.6	158	167	131	4	074	10	73	67	0	--
0300	27	3	3	.2	.6	1.7	170	164	125	3	102	13	72	67	0	--
0400	27	3	2	.3	.6	1.6	171	158	126	4	053	11	72	67	0	29.88
0500	26	3	2	.3	.6	1.6	164	167	115	4	069	8	72	67	0	--
0600	22	4	3	.3	.6	1.6	155	155	130	4	048	8	73	67	0	--
0700	20	8	4	.3	.9	1.6	168	176	134	4	071	9	73	67	55	--
0800	19	8	5	.3	.7	1.6	311	191	138	3	065	11	74	67	74	29.91
0900	20	10	4	.3	.8	1.6	178	141	142	5	067	11	74	68	95	--
1000	21	8	3	.2	.8	1.6	180	141	117	9	065	9	74	69	216	--
1100	28	9	3	.2	.8	1.6	159	161	135	9	065	12	75	70	421	--
1200	34	7	2	.2	.6	1.6	166	165	117	9	077	14	77	69	628	29.89
1300	40	7	2	.2	.6	1.6	161	139	107	7	068	15	81	71	893	--
1400	40	7	1	.1	.6	1.6	152	129	139	8	088	16	79	69	682	--
1500	42	7	2	.3	.7	1.6	170	149	155	6	131	18	83	72	1215	--
1600	--	--	-	--	--	---	149	133	124	-	---	--	--	--	----	29.85
1700	42	3	3	.2	.6	1.6	167	141	128	4	232	22	74	71	51	--
1800	39	7	3	.2	.6	1.6	173	124	152	4	110	20	73	72	102	--
1900	37	4	3	.2	.7	1.6	152	140	130	3	106	16	73	71	112	--
2000	33	5	3	.2	.7	1.6	157	137	126	3	104	12	74	69	79	29.84
2100	29	4	5	.3	.7	1.6	175	138	145	2	093	11	74	68	0	--
2200	32	5	2	.3	.7	1.6	175	138	145	3	104	15	73	67	0	--
2300	31	6	4	.1	.7	1.7	171	134	160	2	124	14	72	66	0	--
2400	34	4	3	.2	.7	1.7	182	148	178	3	136	12	72	66	0	29.87

TABLE A12 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-28-77

Time	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	34	4	2	.4	.7	1.8	183	125	181	5	137	8	72	66	0	--
0200	32	4	1	.3	.7	1.8	189	125	194	6	137	10	72	66	0	--
0300	29	3	1	.4	.7	1.7	186	118	198	4	141	9	71	66	0	--
0400	26	4	2	.3	.7	1.8	175	144	187	2	112	11	71	66	0	29.86
0500	22	4	-	.3	.7	1.8	178	126	162	3	077	9	71	66	0	--
0600	21	5	2	.3	.7	1.B	174	130	189	4	079	8	71	65	0	--
0700	19	8	4	.4	.7	1.8	170	137	169	4	073	13	72	67	131	--
0800	24	7	3	.4	.7	1.7	167	159	143	5	112	18	75	69	278	29.87
0900	26	7	3	.3	.7	1.7	175	150	136	10	140	11	77	71	484	--
1000	32	6	3	.5	.7	1.7	164	144	157	10	135	12	80	73	548	--
1100	35	7	3	.3	.8	1.7	158	155	172	7	111	19	81	73	500	--
1200	38	6	3	.2	.7	1.7	195	109	142	6	112	20	82	74	553	29.87
1300	41	5	2	.2	.8	1.7	178	81	159	6	109	17	84	75	770	--
1400	43	6	2	.3	.7	1.7	176	109	137	7	129	12	87	76	939	--
1500	39	6	3	.4	.8	1.6	162	120	111	9	151	17	78	71	245	--
1600	35	6	6	.2	.6	1.6	165	128	125	8	199	12	77	68	87	29.82
1700	38	3	3	.2	.6	1.6	157	114	114	4	202	14	73	67	68	--
1800	33	6	5	.2	.6	1.6	173	126	116	3	174	12	73	67	79	--
1900	26	6	6	.2	.7	1.7	167	114	117	4	127	16	74	69	136	--
2000	30	6	3	.2	.6	1.7	158	99	136	5	120	14	74	68	115	29.83
2100	29	5	3	.2	.6	1.7	173	126	144	6	135	11	74	68	0	--
2200	26	5	5	.3	.6	1.6	179	119	179	8	160	10	74	68	0	--
2300	22	4	4	.2	.6	1.7	173	115	177	10	162	8	74	68	0	--
2400	20	4	5	.2	.7	1.7	183	122	183	10	153	10	74	68	0	29.88

TABLE A13 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-29-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	20	3	6	.4	.7	1.7	153	100	158	11	201	9	74	68	0	--
0200	25	3	2	.2	.6	1.7	151	124	165	8	217	6	72	65	0	--
0300	24	3	3	.2	.6	1.7	178	107	178	6	215	6	68	60	0	--
0400	20	3	4	.2	.6	1.7	151	128	174	4	197	7	66	59	0	29.93
0500	20	2	5	.2	.6	1.7	163	105	185	5	191	5	64	57	0	--
0600	16	4	6	.2	.6	1.7	141	119	165	4	189	5	63	56	0	--
0700	11	12	13	.6	.8	1.7	159	118	160	5	184	8	64	56	149	--
0800	11	6	7	.2	.8	1.7	141	113	180	7	205	10.0	68	58	441	30.02
0900	--	--	--	--	--	---	149	114	141	--	---	---	--	--	---	--
1000	--	--	--	--	--	---	148	120	138	--	---	---	--	--	---	--
1100	--	--	--	--	--	---	138	115	148	--	---	---	--	--	---	--
1200	36	3	--	<.1	.8	2.0	148	107	116	6	236	14	76	53	948	30.02
1300	42	4	1	.2	.6	1.6	136	115	129	6	213	22	79	55	1386	--
1400	42	5	4	.2	.6	1.6	144	110	127	7	172	19	81	56	1363	--
1500	38	7	2	.2	6.	1.6	137	117	110	8	146	9	81	56	1305	--
1600	40	7	2	.7	.8	1.6	148	108	138	9	158	16	82	57	1173	29.99
1700	46	6	3	.2	.7	1.6	135	129	212	8	151	13	82	57	895	--
1800	45	7	3	.2	.7	1.6	141	124	134	8	156	14	82	59	688	--
1900	47	6	3	.2	.6	1.6	156	122	125	7	150	10	81	58	428	--
2000	40	5	5	.3	.7	1.6	203	100	127	4	108	14	79	59	182	29.96
2100	31	7	4	.2	.9	1.7	139	119	120	3	076	8	75	60	0	--
2200	24	6	3	.3	.8	1.7	177	107	121	5	066	3	70	61	0	--
2300	19	5	2	.2	.6	1.8	145	100	157	5	065	3	68	61	0	--
2400	21	3	3	.2	.6	1.8	156	121	119	5	064	3	67	60	0	29.96

TABLE A14 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 6-30-77

				GAS	DATA						MET.	DATA				
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	23	4	4	.3	.6	1.7	160	120	87	4	058	3	67	59	0	--
0200	23	3	4	.2	.6	1.7	143	107	94	4	062	3	67	59	0	--
0300	24	3	4	.2	.6	1.7	146	110	93	4	058	4	68	59	0	--
0400	25	3	4	.2	.6	1.7	159	117	102	4	053	5	69	60	0	29.92
0500	26	3	4	.2	.6	1.7	161	125	145	5	052	7	69	61	0	--
0600	28	3	4	.2	.6	1.7	157	127	167	8	058	7	71	63	0	--
0700	26	6	5	.2	.7	1.7	163	117	143	10	063	8	72	65	114	--
0800	25	6	6	.3	.6	1.7	207	117	127	10	093	15	75	68	215	29.84
0900	30	9	6	.3	.7	1.7	181	124	117	9	118	20	80	70	414	--
1000	28	5	2	.7	.6	1.7	171	132	113	12	128	16	84	72	747	--
1100	41	6	9	.2	.6	1.6	159	160	100	17	139	13	87	72	925	--
1200	39	5	7	.4	.6	1.6	156	146	104	18	155	11	88	73	817	29.84
1300	45	5	11	.2	.6	1.6	146	131	115	13	134	14	89	74	1006	--
1400	46	5	4	.2	.6	1.6	148	80	116	16	131	15	91	75	1303	--
1500	44	5	5	.2	.6	1.6	139	135	100	18	136	14	91	74	1058	--
1600	46	6	--	.2	.6	1.6	151	112	100	17	135	13	90	74	828	29.68
1700	51	6	5	.2	.6	1.6	144	115	113	16	140	13	91	75	778	--
1800	45	5	--	.1	.6	1.6	139	130	102	15	182	12	81	70	108	--
1900	34	6	5	.2	.6	1.6	139	104	93	7	146	14	72	69	31	--
2000	37	5	2	.1	.6	1.6	146	93	86	7	134	15	71	68	30	29.80
2100	35	4	2	.1	.5	1.6	151	100	97	12	154	10	72	67	0	--
2200	29	4	4	.2	.6	1.6	157	106	94	12	161	11	73	66	0	--
2300	18	4	7	.3	.6	1.6	155	103	92	10	177	9	73	65	0	--
2400	16	3	6	.4	.6	1.6	150	108	109	6	163	7	72	65	0	29.92

TABLE A15 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-1-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	19	3	3	.2	.6	1.7	147	106	115	6	151	8	71	65	0	--
0200	15	3	5	.3	.6	1.7	150	108	108	6	166	8	70	64	0	--
0300	16	3	5	.4	.6	1.7	147	113	85	6	152	8	70	63	0	--
0400	16	2	2	.3	.6	1.7	147	98	105	6	152	7	69	62	0	29.99
0500	14	3	2	.3	.6	1.8	145	104	102	7	154	7	68	62	0	--
0600	11	4	3	.4	.6	1.7	147	97	91	4	155	7	66	61	0	--
0700	10	9	3	.4	.7	1.7	158	104	97	5	151	12	66	61	113	--
0800	16	7	2	.2	.7	1.7	150	108	92	9	163	10	69	62	358	30.04
0900	21	9	3	.2	.7	1.7	152	119	127	10	163	12	72	63	725	--
1000	21	9	4	.3	.7	1.7	158	113	121	8	168	12	75	62	956	--
1100	34	5	6	.2	.6	1.6	151	109	94	12	198	10	78	56	1196	--
1200	41	3	2	.2	.6	1.6	138	106	87	14	198	10	79	54	1327	30.06
1300	40	3	2	.1	.5	1.6	154	93	102	13	207	12	80	55	1390	--
1400	43	4	2	.1	.5	1.6	153	105	105	13	199	13	81	55	1382	--
1500	42	4	2	.1	.6	1.6	148	111	108	13	198	14	81	55	1299	--
1600	46	3	2	.2	.6	1.6	148	102	90	15	210	10	82	55	1145	30.03
1700	43	3	2	--	--	---	143	105	110	14	210	10	82	54	923	--
1800	38	2	1	.1	.5	1.6	147	107	105	16	214	9	82	53	704	--
1900	39	2	1	.1	.5	1.6	155	99	89	12	205	8	81	55	447	--
2000	35	2	1	.2	.5	1.6	153	97	83	7	206	4	78	59	173	30.03
2100	19	13	6	.2	.6	1.6	187	107	81	4	201	3	74	61	0	--
2200	12	21	6	.4	.4	1.6	160	119	89	2	135	7	71	59	0	--
2300	15	9	4	.3	.7	1.8	145	140	97	2	098	10	68	58	0	--
2400	9	9	3	.3	.6	1.8	170	101	90	2	094	7	65	57	0	30.11

TABLE A16 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-2-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	6	10	3	.3	.7	1.8	146	104	91	2	085	6	64	57	0	--
0200	10	6	3	.3	.6	1.7	142	106	88	2	091	9	63	56	0	--
0300	5	7	6	.3	.6	1.7	142	119	94	-	199	10	62	55	0	--
0400	4	5	6	.4	.6	1.7	150	115	112	-	310	12	61	55	0	30.15
0500	5	4	5	.4	.7	1.8	166	111	105	1	155	11	61	55	0	--
0600	5	5	4	.4	.7	1.8	166	105	110	1	071	4	60	54	0	--
0700	3	12	2	.3	.8	1.8	166	106	124	1	063	4	61	56	152	--
0800	10	9	3	.3	.8	1.8	156	117	108	1	197	13	67	60	405	30.20
0900	25	4	3	.5	.7	1.8	162	113	29	4	225	14	73	61	718	--
1000	33	7	2	.4	.7	1.7	155	114	100	4	301	14	77	58	957	--
1100	6	3	5	.2	.5	1.6	166	118	100	4	269	19	80	55	1155	--
1200	48	4	3	.2	.5	1.7	159	111	118	2	181	15	82	56	1303	30.22
1300	58	3	4	.8	.7	1.7	152	116	79	3	147	16	84	57	1381	--
1400	65	3	2	.3	.5	1.6	156	118	94	4	221	19	84	57	1246	--
1500	63	3	5	.3	.5	1.6	184	111	106	5	208	16	85	57	1254	--
1600	59	3	3	.8	.7	1.6	139	106	96	5	241	19	85	58	1078	30.18
1700	58	3	1	.1	.5	1.6	149	110	93	6	264	15	85	58	930	--
1800	56	3	--	.1	.5	1.6	157	109	83	6	278	15	85	58	712	--
1900	57	3	2	.1	.5	1.6	157	116	108	6	300	13	84	57	401	--
2000	56	4	3	.2	.5	1.6	173	115	101	6	349	8	83	59	162	30.04
2100	26	9	12	.1	.6	1.7	203	125	232	4	024	9	78	61	0	--
2200	21	9	10	.4	1.1	1.7	195	118	92	4	021	6	75	62	0	--
2300	37	5	7	.3	.8	1.8	152	101	107	4	043	8	73	61	0	--
2400	38	4	5	.4	.7	1.9	165	106	91	3	038	6	73	59	0	30.18

TABLE A17. SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-3-77

	GAS	DATA								MET.	DATA					
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	29	5	6	.3	.7	1.7	182	101	107	3	052	5	70	59	0	--
0200	25	4	7	.3	.7	1.7	176	102	124	2	034	5	69	59	0	--
0300	15	6	10	.3	.8	1.7	172	100	115	2	026	7	67	58	0	--
0400	24	3	4	.3	.6	1.8	199	114	140	2	033	5	66	58	0	30.14
0500	21	3	4	.3	.6	1.8	175	107	99	4	033	5	65	57	0	--
0600	21	4	4	.3	.6	1.8	158	106	111	4	044	4	65	57	0	--
0700	20	4	4	.2	.6	1.8	168	108	97	5	050	5	66	58	134	--
0800	25	4	4	.2	.6	1.8	161	110	124	6	061	8	71	60	383	30.17
0900	34	4	5	.2	.6	1.7	163	121	104	8	064	9	76	62	639	--
1000	48	4	5	.2	.7	1.7	161	116	111	8	078	15	80	64	895	--
1100	60	4	5	.4	.6	1.6	164	119	102	10	103	16	83	64	1068	--
1200	40	6	-	.4	.5	1.6	154	124	102	10	101	17	84	64	1070	30.15
1300	66	2	-	.5	.6	1.6	165	122	108	11	105	19	84	64	1049	--
1400	69	6	-	.4	.7	1.6	150	111	106	9	112	20	86	64	1054	--
1500	68	15	-	1.0	.7	1.6	169	119	113	11	101	18	85	64	89	--
1600	67	16	4	2.0	.8	1.6	155	111	113	10	108	18	86	65	924	30.10
1700	--	--	-	5.8	.7	2.1	169	112	102	--	---	--	--	--	----	--
1800	--	--	-	.4	.7	1.6	160	108	110	--	---	--	--	--	----	--
1900	--	--	-	.3	.7	1.6	162	126	108	--	---	--	--	--	----	--
2000	69	3	2	.3	.6	1.6	154	112	100	6	100	10	80	66	718	30.08
2100	64	1	2	.3	.7	1.6	170	118	105	4	100	14	79	65	0	--
2200	51	--	1	.3	.6	1.7	167	117	102	6	095	5	75	65	0	--
2300	51	1	-	.4	.7	1.7	173	112	105	5	097	12	75	65	0	--
2400	52	--	2	.5	.7	1.7	177	114	117	5	085	9	74	65	0	30.12

TABLE A18 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-4-77

	GAS	DATA								MET.	DATA					
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	45	--	--	.5	.6	1.7	166	108	116	5	075	5	72	64	0	--
0200	41	--	--	.4	.6	1.7	169	97	107	6	080	8	72	64	0	--
0300	40	--	--	.5	.6	1.7	156	117	110	4	105	16	73	64	0	--
0400	37	--	--	.5	.6	1.7	150	110	109	4	112	20	73	63	0	30.12
0500	29	--	--	.5	.6	1.7	166	106	116	3	046	9	72	63	0	--
0600	22	--	2	.4	.6	1.8	166	112	100	2	084	13	71	63	0	--
0700	23	--	2	.4	.7	1.8	175	118	91	3	073	9	72	63	119	--
0800	28	--	2	.5	.7	1.7	168	114	94	5	110	15	76	66	369	30.16
0900	42	--	2	.5	.6	1.6	169	128	101	9	151	12	81	67	642	--
1000	47	--	3	.4	.6	1.6	166	125	81	10	162	12	84	69	890	--
1100	56	--	5	.6	.6	1.6	158	138	87	8	169	13	86	72	1099	--
1200	67	--	5	.6	.7	1.6	172	146	83	7	168	14	89	73	1237	30.15
1300	64	--	2	.7	.7	1.7	164	126	94	8	161	15	91	73	1305	--
1400	58	5	--	.4	.6	1.6	159	129	84	8	145	15	92	73	1307	--
1500	53	8	4	.4	.6	1.6	142	128	103	9	148	18	93	72	1224	--
1600	55	7	10	.2	.7	1.6	149	144	105	9	158	14	94	72	1090	30.12
1700	60	6	--	.3	.7	1.6	158	117	102	7	143	14	94	72	891	--
1800	58	4	18	.2	.7	1.6	228	134	98	6	137	16	93	72	481	--
1900	62	6	3	.3	.7	1.6	260	116	94	5	130	15	92	73	390	--
2000	57	7	2	.3	.7	1.6	515	140	96	3	125	14	90	73	169	30.10
2100	40	9	3	.3	.7	1.7	144	118	100	4	101	9	85	73	0	--
2200	36	7	2	.3	.7	1.7	294	117	84	5	104	10	82	71	0	--
2300	37	4	2	.4	.6	1.7	172	110	78	3	121	14	81	70	0	--
2400	26	7	5	.4	.7	1.7	179	110	78	3	086	13	79	68	0	30.12

TABLE A19 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-5-77

	GAS	DATA								MET.	DATA					
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	15	9	10	.4	.8	1.8	178	110	94	1	187	7	76	67	0	--
0200	16	4	5	.4	.6	1.8	154	117	81	1	058	10	75	67	0	--
0300	23	3	3	.4	.6	1.8	187	112	102	1	112	8	75	67	0	--
0400	16	4	3	.4	.6	1.8	244	112	132	1	027	6	73	66	0	30.13
0500	18	4	3	.4	.6	1.9	166	116	83	3	078	8	73	66	0	--
0600	18	4	3	.4	.6	1.9	205	117	99	3	120	10	73	66	0	--
0700	16	9	7	.5	.7	1.8	170	123	94	2	108	18	76	68	115	--
0800	24	6	4	.4	.8	1.8	165	108	86	4	145	17	80	71	362	30.19
0900	28	8	9	.8	.8	1.7	163	127	164	8	183	11	84	72	640	--
1000	46	6	4	.6	.7	1.7	147	124	137	6	189	13	87	73	887	--
1100	66	4	6	.4	.7	1.6	178	173	97	7	201	12	89	73	1090	--
1200	78	5	3	.4	.7	1.6	162	164	92	5	218	16	91	73	1251	30.17
1300	70	5	-	.2	.7	1.6	164	111	118	5	205	20	93	72	1323	--
1400	64	6	1	.2	.7	1.6	167	134	90	4	206	19	94	70	1339	--
1500	75	4	3	.3	.7	1.6	175	142	113	4	139	21	94	71	1142	--
1600	81	6	3	.7	.8	1.7	163	156	84	6	150	16	94	71	1083	30.07
1700	67	7	4	.3	.7	1.6	144	132	105	7	139	15	94	71	755	--
1800	43	8	1	.3	.7	1.6	151	127	92	5	136	17	92	73	545	--
1900	43	8	4	.3	.7	1.6	147	127	95	5	163	10	92	74	370	--
2000	44	6	7	.3	.7	1.7	346	144	81	4	150	8	89	74	140	30.08
2100	37	7	6	.3	.7	1.7	158	144	99	4	085	6	85	74	0	--
2200	27	6	6	.4	.8	1.7	182	117	99	5	094	4	82	74	0	--
2300	32	7	3	.3	.7	1.8	168	104	93	4	100	11	81	73	0	--
2400	28	3	3	.4	.7	1.8	200	107	122	5	095	10	80	71	0	30.06

TABLE A20 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-6-77

Time	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	39	4	3	.5	.7	1.8	210	110	120	4	122	18	80	70		
0200	36	3	4	.4	.6	1.7	190	111	100	3	127	14	80	69	0	--
0300	36	2	1	.3	.6	1.7	174	117	103	3	097	14	79	69	0	--
0400	30	4	4	.3	.6	1.7	167	120	107	3	136	11	76	68	0	--
0500	18	3	6	.3	.7	1.8	182	117	112	2	125	10	74	67	0	30.05
0600	17	3	7	.3	.7	1.8	178	119	104	2	126	10	74	67	0	--
0700	22	9	15	.3	.7	1.8	188	133	100	3	117	15	76	68	0	--
0800	25	6	11	.3	.8	1.8	163	126	100	6	144	15	82	71	148	--
0900	36	8	16	.6	.8	1.7	176	125	167	7	183	12	85	72	369	30.08
1000	50	5	11	.4	.8	1.7	167	146	102	6	189	12	87	74	653	--
1100	53	7	8	.4	.8	1.7	171	169	127	6	150	16	89	76	645	--
1200	55	6	5	.3	.8	1.7	158	107	100	10	168	12	92	76	965	--
1300	59	5	1	.2	.7	1.7	152	133	89	11	158	13	93	75	1221	30.04
1400	55	6	4	.3	.7	1.6	156	130	99	10	169	14	94	74	1302	--
1500	58	8	2	.3	.7	1.6	178	90	111	9	159	13	95	74	1307	--
1600	54	7	3	.3	.7	1.6	---	---	---	9	151	13	95	74	1273	--
1700	60	7	7	.3	.7	1.6	---	---	---	10	146	14	96	74	1066	29.99
1800	62	8	2	.3	.7	1.6	---	---	---	9	143	11	95	74	909	--
1900	59	5	2	.3	.7	1.6	162	---	127	7	140	13	93	75	641	--
2000	72	5	4	.3	.7	1.6	179	171	105	3	123	17	90	75	376	--
2100	59	5	3	.2	.7	1.7	169	256	127	3	119	16	87	74	139	29.83
2200	50	4	4	.3	.7	1.7	131	226	114	3	123	14	85	72	0	--
2300	44	5	6	.2	.7	1.7	88	200	132	2	122	10	83	72	0	--
2400	49	4	2	.2	.7	1.7	10	52	24	3	128	12	82	70	0	29.96

TABLE A21 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-7-77

	GAS	DATA								MET.	DATA					
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	46	2	2	.2	.7	1.7	60	51	25	3	131	11	80	70	0	--
0200	42	3	2	.3	.7	1.7	193	217	153	5	140	8	79	70	0	--
0300	39	2	2	.2	.7	1.7	185	231	140	7	141	7	79	70	0	--
0400	33	2	2	.3	.7	1.7	194	222	110	6	141	10	79	70	0	29.95
0500	28	4	1	.3	.7	1.7	186	110	129	3	128	15	78	70	0	--
0600	22	3	2	.3	.7	1.7	181	214	123	3	136	10	77	69	0	--
0700	15	10	7	.4	.8	1.7	177	202	118	2	069	16	78	69	123	--
0800	25	7	6	.3	.8	1.8	181	208	137	7	162	10	82	72	343	29.97
0900	29	20	15	.8	.9	1.8	176	225	122	9	179	9	86	73	598	--
1000	28	8	4	.3	.7	1.7	178	108	110	12	159	10	89	75	875	--
1100	51	10	17	.3	.8	1.7	188	100	118	11	155	11	90	76	1019	--
1200	--	--	--	--	--	---	171	101	135	--	---	--	--	--	----	29.95
1300	62	12	13	.1	.7	1.7	188	99	151	11	161	13	94	71	1236	--
1400	54	7	5	.1	.7	1.6	175	98	132	12	161	13	95	74	1301	--
1500	76	8	10	1.1	.8	1.7	157	94	102	13	148	12	95	74	1189	--
1600	78	7	1	.2	.6	1.6	164	95	119	12	153	12	96	74	1064	29.91
1700	55	8	14	.2	.7	1.6	162	86	115	14	152	10	96	74	954	--
1800	--	--	--	--	--	---	156	101	115	--	---	--	--	--	----	--
1900	45	6	8	.3	.6	1.3	157	99	112	5	278	12	92	76	352	--
2000	56	6	4	.2	.7	1.7	151	93	77	4	297	14	90	73	137	29.89
2100	54	5	3	.4	.8	1.6	140	86	104	2	292	12	87	73	0	--
2200	50	4	4	.3	.7	1.7	157	87	129	3	308	12	84	73	0	--
2300	23	6	11	.3	.8	1.7	164	81	100	2	229	10	81	73	0	--
2400	39	4	6	.3	.8	1.8	163	92	98	4	305	6	82	72	0	29.99

TABLE A 22 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-8-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	42	4	4	.4	.8	1.8	177	94	114	5	261	15	83	72	0	--
0200	36	3	4	.4	.8	1.7	179	101	111	6	206	13	82	71	0	--
0300	43	3	2	.2	.6	1.7	167	80	97	10	229	7	78	68	0	--
0400	41	3	-	.1	.6	1.7	169	78	107	5	249	14	76	66	0	29.95
0500	39	4	3	.1	.6	1.7	171	87	111	5	259	8	75	66	0	--
0600	36	4	2	.1	.6	1.7	180	87	100	3	269	14	75	66	0	--
0700	36	8	5	.2	.7	1.7	191	92	138	3	276	13	76	67	128	--
0800	25	7	3	.3	.7	1.7	170	98	117	5	286	16	79	70	282	30.00
0900	31	10	7	.6	.8	1.7	216	101	190	7	310	18	84	75	625	--
1000	47	16	6	.4	.9	1.8	184	107	144	9	323	13	88	77	901	--
1100	58	10	4	.4	.8	1.7	185	101	147	9	326	15	90	77	1060	--
1200	64	9	8	.3	.8	1.7	169	106	148	10	342	13	92	76	847	30.04
1300	61	9	5	.2	.7	1.6	176	98	113	11	015	11	91	75	730	--
1400	79	7	6	.2	.6	1.6	159	101	119	14	020	10	93	74	955	--
1500	66	7	1	.2	.7	1.6	163	88	114	9	246	16	86	71	175	--
1600	46	13	5	.2	.7	1.6	173	87	116	7	289	15	82	70	345	29.98
1700	45	7	6	.2	.7	1.6	176	82	100	4	209	12	82	73	216	--
1800	54	3	3	.2	.6	1.6	166	83	99	12	146	12	82	71	540	--
1900	54	3	3	.2	.6	1.6	197	73	106	7	156	9	79	68	181	--
2000	42	5	5	.2	.6	1.6	192	98	121	4	203	8	78	69	37	30.04
2100	24	5	5	.2	.7	1.7	180	91	123	2	237	13	76	69	0	--
2200	18	4	4	.2	.6	1.6	192	91	96	3	043	12	75	69	0	--
2300	12	10	10	.1	.7	1.7	182	91	106	1	265	14	74	68	0	--
2400	6	9	10	.5	.7	1.7	180	87	115	2	178	13	74	68	0	30.07

TABLE A23 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-9-77

			GAS	DATA							MET.	DATA				
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	6	9	11	.9	.8	1.7	197	88	131	3	189	12	73	68	0	--
0200	11	4	8	.6	.7	1.7	220	82	116	6	057	6	74	68	0	--
0300	17	3	3	.3	.6	1.6	244	91	127	4	071	11	74	68	0	--
0400	16	3	3	.2	.6	1.6	317	76	125	4	074	11	74	68	0	30.08
0500	20	3	2	.2	.6	1.6	345	94	149	1	157	13	73	68	0	--
0600	19	3	3	.2	.6	1.6	490	93	155	3	070	12	73	67	0	--
0700	18	4	2	.3	.6	1.6	640	92	176	5	111	10	73	67	50	--
0800	18	3	4	.3	.6	1.6	697	87	170	3	111	11	73	67	85	30.14
0900	17	4	5	.3	.6	1.6	695	93	186	3	123	13	74	67	159	--
1000	20	5	3	.3	.7	1.6	574	87	186	2	133	13	75	68	291	--
1100	26	4	3	.2	.6	1.6	535	84	173	3	129	22	77	69	422	--
1200	37	4	2	.2	.6	1.6	483	91	196	4	145	19	80	70	973	30.16
1300	58	3	1	.2	1.0	1.7	---	---	---	5	119	22	85	70	1200	--
1400	65	3	-	.2	.6	1.6	240	98	199	6	133	25	88	69	1225	--
1500	76	3	2	.2	.7	1.6	211	94	166	9	150	27	89	69	1225	--
1600	72	4	-	.3	.7	1.6	181	89	149	8	179	27	90	68	1091	30.12
1700	72	3	-	.5	.6	1.6	180	91	159	7	188	21	89	68	927	--
1800	69	3	1	.5	.6	1.6	164	90	147	9	218	19	88	68	503	--
1900	65	2	1	.4	.6	1.6	138	95	152	8	155	9	88	68	365	--
2000	59	4	2	.4	.6	1.6	191	88	178	6	196	8	86	68	277	30.09
2100	47	6	7	.5	.7	1.6	203	90	164	2	281	12	80	68	0	--
2200	20	8	16	.5	.8	1.7	192	90	180	1	220	11	78	68	0	--
2300	21	3	7	.5	.7	1.7	189	87	165	2	147	5	77	69	0	--
2400	14	8	8	.5	.7	1.7	185	79	151	1	050	6	75	68	0	30.14

TABLE A24 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-10-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	20	4	6	.5	.7	1.7	184	85	196	5	084	9	75	68	0	--
0200	26	3	6	.5	.7	1.8	182	98	223	6	133	8	75	68	0	--
0300	27	3	5	.5	.7	1.8	193	85	215	6	120	10	75	68	0	--
0400	15	2	12	.5	.7	1.7	194	84	182	6	129	7	73	65	0	30.12
0500	17	2	7	.6	.6	1.7	188	85	180	5	141	8	72	64	0	--
0600	18	2	4	.5	.6	1.7	177	76	199	3	128	11	72	64	0	--
0700	15	3	4	.7	.6	1.7	182	80	206	4	097	10	72	64	75	--
0800	15	3	5	.6	.6	1.7	193	75	198	5	228	15	72	64	74	30.13
0900	14	4	5	.5	.6	1.8	185	90	200	4	221	10	72	67	56	--
1000	23	10	3	.5	.7	1.8	198	95	208	4	273	15	73	71	190	--
1100	25	4	3	.4	.7	1.8	160	86	175	6	205	12	75	70	364	--
1200	38	6	2	.5	.7	1.7	188	83	144	5	235	13	77	71	825	30.14
1300	48	5	1	.5	.7	1.7	180	85	145	4	207	19	82	72	918	--
1400	46	3	1	--	--	--	152	90	143	7	184	16	82	71	906	--
1500	54	3	1	--	--	--	165	81	125	9	205	9	82	70	483	--
1600	49	4	2	--	--	--	178	84	163	8	227	9	79	70	419	30.08
1700	44	4	4	--	--	--	182	83	164	9	222	9	79	71	173	--
1800	30	8	8	.5	.8	1.7	252	68	754	4	237	7	79	71	68	--
1900	32	5	6	.6	.7	1.6	178	83	180	7	217	8	77	70	113	--
2000	36	2	3	.5	.7	1.7	198	90	199	6	205	8	77	70	38	30.08
2100	30	4	4	.5	.7	1.7	183	97	174	6	224	7	76	69	0	--
2200	30	3	3	.5	.6	1.6	182	86	191	6	237	4	75	69	0	--
2300	29	3	3	.5	.6	1.7	185	86	194	6	233	6	75	68	0	--
2400	28	2	2	.4	.6	1.7	175	90	143	6	225	7	74	68	0	30.07

TABLE A25 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-11-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	22	3	3	.4	.6	1.7	172	82	177	8	238	6	74	68	0	--
0200	21	3	4	.5	.6	1.7	179	95	180	9	240	6	74	68	0	--
0300	22	3	3	.5	.7	1.7	176	90	168	10	245	5	74	68	0	--
0400	21	3	3	.5	.7	1.7	164	91	172	8	250	5	74	69	0	30.02
0500	20	3	2	.5	.7	1.8	176	89	154	6	258	7	74	69	0	--
0600	20	4	2	.5	.7	1.8	170	89	156	5	257	7	74	69	0	--
0700	21	6	4	.5	.8	1.8	173	87	156	6	271	9	75	70	66	--
0800	25	7	3	.5	.8	1.8	393	92	133	6	279	12	75	70	166	30.04
0900	32	6	3	.8	.8	1.8	412	96	128	7	290	16	77	71	342	--
1000	33	8	2	.9	.6	3.0	---	---	---	5	293	16	76	69	118	--
1100	40	6	2	<.1	.7	6.0	---	---	---	7	283	18	77	70	662	--
1200	--	-	-	1.9	.6	2.1	---	---	---	-	---	--	--	--	---	30.02
1300	49	5	2	.5	.6	1.6	---	---	---	9	289	18	80	72	727	--
1400	44	4	1	.4	.6	1.6	---	---	---	9	308	16	73	68	149	--
1500	38	6	2	.3	.6	1.6	---	---	---	6	288	16	74	69	530	--
1600	--	--	--	--	--	--	---	---	---	--	---	--	--	--	---	29.96
1700	--	--	--	--	--	--	---	---	---	--	---	--	--	--	---	--
1800	41	6	--	--	--	--	---	---	---	7	287	16	79	71	603	--
1900	57	42	12	--	--	--	---	---	---	1	196	6	67	51	1040	--
2000	41	8	2	--	--	--	---	---	---	4	293	17	76	67	208	29.99
2100	33	4	2	--	--	--	194	129	141	4	265	8	76	69	21	--
2200	26	5	3	--	--	--	199	134	150	3	249	4	74	69	0	--
2300	20	5	2	--	--	--	205	136	147	4	246	4	74	68	0	--
2400	21	3	2	--	--	--	197	132	165	5	254	6	74	68	0	30.01

TABLE A26 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-12-77

Time	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	18	2	3	--	--	--	--	--	--	3	252	6	74	69	0	--
0200	16	2	3	--	--	--	--	--	--	4	272	8	73	68	0	--
0300	18	2	2	--	--	--	--	--	--	4	275	10	73	68	0	--
0400	20	2	1	--	--	--	--	--	--	5	274	7	73	68	0	--
0500	22	2	0	--	--	--	--	--	--	4	292	18	74	68	0	--
0600	23	2	--	--	--	--	--	--	--	7	304	18	75	69	2	--
0700	21	6	3	--	--	--	--	--	--	7	333	9	76	70	57	--
0800	20	5	3	--	--	--	--	--	--	7	179	10	76	70	101	--
0900	16	7	5	--	--	--	--	--	--	3	312	17	77	71	198	--
1000	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1100	37	6	2	--	--	--	--	--	--	7	236	13	83	75	1162	--
1200	45	5	1	--	--	--	--	--	--	8	247	12	86	73	1245	--
1300	49	6	1	--	--	--	--	--	--	8	244	10	87	71	1095	--
1400	49	8	2	--	--	--	--	--	--	7	230	14	87	72	866	--
1500	51	10	2	--	--	--	--	--	--	8	221	18	87	72	863	--
1600	58	37	37	--	--	--	--	--	--	2	220	7	71	55	938	--
1700	56	6	2	--	--	--	--	--	--	9	227	18	88	70	931	--
1800	58	4	2	--	--	--	--	--	--	10	243	6	88	70	634	--
1900	52	5	1	--	--	--	--	--	--	7	238	7	88	71	338	--
2000	40	5	3	--	--	--	--	--	--	3	233	11	85	73	100	--
2100	27	8	6	--	--	--	--	--	--	2	220	7	82	73	23	--
2200	36	4	2	--	--	--	--	--	--	3	223	14	82	72	0	--
2300	27	6	4	--	--	--	--	--	--	2	209	9	79	71	0	--
2400	25	4	2	--	--	--	--	--	--	3	214	8	78	72	0	--

TABLE A27. SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-13-77

	GAS	DATA								MET.	DATA					
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	26	2	2	--	--	--	--	--	--	3	211	15	79	72	0	--
0200	23	2	1	--	--	--	--	--	--	3	217	17	79	72	0	--
0300	20	3	1	--	--	--	--	--	--	3	221	15	78	72	0	--
0400	16	2	1	--	--	--	--	--	--	2	202	12	78	72	0	--
0500	12	2	1	--	--	--	--	--	--	4	213	8	79	73	4	--
0600	12	3	2	--	--	--	--	--	--	4	229	13	80	73	18	--
0700	10	6	3	--	--	--	--	--	--	4	231	15	80	73	94	--
0800	8	6	3	--	--	--	--	--	--	4	241	8	81	74	263	--
0900	15	4	4	--	--	--	--	--	--	8	270	10	83	75	561	--
1000	36	3	2	--	--	--	--	--	--	6	289	13	86	77	802	--
1100	52	3	4	--	--	--	--	--	--	2	232	17	89	79	1020	--
1200	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1300	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1400	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1500	49	5	0	--	--	--	--	--	--	5	235	18	94	76	1234	--
1600	44	5	0	--	--	--	--	--	--	6	244	17	95	76	1115	--
1700	46	8	0	--	--	--	--	--	--	5	226	19	95	77	862	--
1800	50	7	0	--	--	--	--	--	--	7	236	13	94	77	642	--
1900	47	6	0	--	--	--	--	--	--	5	239	8	92	76	223	--
2000	37	6	2	--	--	--	--	--	--	3	207	12	91	78	128	--
2100	23	9	2	--	--	--	--	--	--	3	196	7	87	78	20	--
2200	30	6	4	--	--	--	--	--	--	4	210	13	86	77	4	--
2300	24	5	2	--	--	--	--	--	--	4	196	83	83	76	0	--
2400	25	3	2	--	--	--	--	--	--	3	195	13	83	74	0	--

TABLE A28 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-14-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	15	2	3	--	--	--	--	--	--	3	196	9	81	74	0	--
0200	14	2	6	--	--	--	--	--	--	5	200	9	80	74	0	--
0300	20	2	2	--	--	--	--	--	--	3	167	12	80	74	0	--
0400	18	1	2	--	--	--	--	--	--	5	114	12	79	73	0	--
0500	14	2	5	--	--	--	--	--	--	5	137	7	76	70	0	--
0600	11	4	2	--	--	--	--	--	--	2	176	10	76	71	0	--
0700	2	21	6	--	--	--	--	--	--	1	228	11	76	72	77	--
0800	9	8	4	--	--	--	--	--	--	3	136	10	80	74	303	--
0900	19	9	3	--	--	--	--	--	--	4	176	10	83	76	525	--
1000	37	3	2	--	--	--	--	--	--	3	254	19	86	78	792	--
1100	43	8	6	--	--	--	--	--	--	6	258	12	89	78	970	--
1200	44	8	4	--	--	--	--	--	--	6	257	13	91	77	1160	--
1300	52	7	4	--	--	--	--	--	--	7	259	14	92	77	1259	--
1400	53	7	4	--	--	--	--	--	--	5	230	19	93	77	1263	--
1500	57	5	1	--	--	--	--	--	--	7	211	16	93	76	1013	--
1600	46	9	7	--	--	--	--	--	--	6	206	18	93	76	872	--
1700	51	7	4	--	--	--	--	--	--	6	197	16	93	76	858	--
1800	50	6	1	--	--	--	--	--	--	6	205	16	93	76	498	--
1900	51	5	0	--	--	--	--	--	--	5	210	16	91	76	375	--
2000	44	4	2	--	--	--	--	--	--	2	228	11	90	77	188	--
2100	32	9	4	--	--	--	--	--	--	3	201	7	87	76	20	--
2200	27	5	4	--	--	--	--	--	--	3	203	8	83	75	0	--
2300	10	12	8	--	--	--	--	--	--	1	182	12	80	73	0	--
2400	6	3	6	--	--	--	--	--	--	--	79	14	78	72	0	--

TABLE A29. SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-15-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	--	21	8	--	--	--	--	--	--	--	79	4	78	72	0	--
0200	0	11	7	--	--	--	--	--	--	--	191	7	76	70	0	--
0300	1	8	6	--	--	--	--	--	--	--	284	7	74	69	0	--
0400	0	7	3	--	--	--	--	--	--	1	208	5	74	69	0	--
0500	1	5	3	--	--	--	--	--	--	1	248	8	74	68	0	--
0600	--	11	2	--	--	--	--	--	--	0	180	1	73	68	2	--
0700	2	17	3	--	--	--	--	--	--	0	149	14	75	69	82	--
0800	6	13	14	--	--	--	--	--	--	1	167	10	79	74	294	--
0900	34	13	6	--	--	--	--	--	--	3	270	13	85	78	553	--
1000	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1100	61	4	2	--	--	--	--	--	--	4	234	19	91	79	1026	--
1200	65	3	5	--	--	--	--	--	--	5	256	17	92	78	1098	--
1300	79	4	4	--	--	--	--	--	--	5	275	21	92	77	1219	--
1400	79	2	14	--	--	--	--	--	--	4	244	20	93	77	1010	--
1500	77	5	27	--	--	--	--	--	--	6	199	19	95	76	1182	--
1600	64	6	12	--	--	--	--	--	--	5	219	18	95	75	1059	--
1700	56	5	12	--	--	--	--	--	--	5	228	16	95	75	641	--
1800	60	6	6	--	--	--	--	--	--	5	230	17	94	75	618	--
1900	62	26	7	--	--	--	--	--	--	4	217	15	93	77	357	--
2000	50	9	6	--	--	--	--	--	--	4	213	9	89	77	94	--
2100	27	7	11	--	--	--	--	--	--	2	266	11	85	76	11	--
2200	9	24	16	--	--	--	--	--	--	1	231	8	85	77	0	--
2300	7	11	7	--	--	--	--	--	--	1	226	9	82	76	0	--
2400	6	11	8	--	--	--	--	--	--	--	111	7	80	74	0	--

TABLE A30 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-16-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	2	7	8	--	--	--	--	--	--	--	96	7	79	73	0	--
0200	2	5	5	--	--	--	--	--	--	1	132	9	78	72	0	--
0300	6	3	4	--	--	--	--	--	--	1	158	6	77	71	0	--
0400	3	7	5	--	--	--	--	--	--	--	139	7	76	71	0	--
0500	8	2	4	--	--	--	--	--	--	5	45	5	77	71	0	--
0600	12	1	6	--	--	--	--	--	--	9	46	5	76	69	0	--
0700	25	1	2	--	--	--	--	--	--	5	47	--	76	66	57	--
0800	29	1	1	--	--	--	--	--	--	3	50	0	77	67	183	--
0900	30	3	2	--	--	--	--	--	--	8	52	1	79	68	490	--
1000	37	4	1	--	--	--	--	--	--	9	81	9	84	70	9	--
1100	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1200	50	5	2	--	--	--	--	--	--	7	133	9	70	48	626	--
1300	55	5	2	--	--	--	--	--	--	6	195	13	89	76	819	--
1400	63	3	3	--	--	--	--	--	--	7	205	15	91	78	1057	--
1500	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1600	73	8	7	--	--	--	--	--	--	4	249	21	89	75	939	--
1700	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1800	63	3	3	--	--	--	--	--	--	13	108	8	86	72	218	--
1900	47	4	4	--	--	--	--	--	--	11	59	1	79	64	214	--
2000	48	2	3	--	--	--	--	--	--	3	55	5	78	66	112	--
2100	37	1	4	--	--	--	--	--	--	3	50	4	77	66	17	--
2200	30	5	6	--	--	--	--	--	--	2	160	13	75	65	0	--
2300	13	9	8	--	--	--	--	--	--	84	---	9	74	66	0	--
2400	13	4	5	--	--	--	--	--	--	3	183	14	73	66	0	--

TABLE A31 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-17-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	17	2	2	--	--	--	--	--	--	3	71	10	73	66	0	--
0200	16	3	3	--	--	--	--	--	--	3	126	9	74	66	2	--
0300	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	--
0400	--	--	--	--	--	--	--	--	--	--	---	--	--	--	--	--
0500	6	3	5	--	--	--	--	--	--	1	112	10	73	67	0	--
0600	8	2	3	--	--	--	--	--	--	4	52	8	74	68	0	--
0700	17	3	6	--	--	--	--	--	--	11	53	3	76	67	55	--
0800	28	3	3	--	--	--	--	--	--	6	59	3	77	56	232	--
0900	31	4	2	--	--	--	--	--	--	6	77	7	79	68	526	--
1000	36	5	1	--	--	--	--	--	--	8	178	12	81	69	739	--
1100	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1200	49	5	0	--	--	--	--	--	--	8	215	15	89	13	116	--
1300	61	4	2	--	--	--	--	--	--	8	250	15	91	74	1248	--
1400	68	3	0	--	--	--	--	--	--	6	264	19	93	74	1235	--
1500	69	2	1	--	--	--	--	--	--	5	273	19	93	75	995	--
1600	73	4	3	--	--	--	--	--	--	6	267	15	93	74	909	--
1700	88	3	2	--	--	--	--	--	--	7	261	13	93	75	756	--
1800	77	3	3	--	--	--	--	--	--	6	251	9	92	74	394	--
1900	57	4	3	--	--	--	--	--	--	4	243	10	91	75	204	--
2000	43	4	6	--	--	--	--	--	--	2	235	9	89	76	108	--
2100	29	5	4	--	--	--	--	--	--	4	200	4	85	77	18	--
2200	29	7	6	--	--	--	--	--	--	3	209	11	84	76	0	--
2300	28	4	3	--	--	--	--	--	--	4	208	8	82	75	0	--
2400	31	2	1	--	--	--	--	--	--	3	211	10	81	74	0	--

TABLE A32. SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-18-77

Time	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	26	1	1	--	--	--	--	--	--	3	203	9	79	73	0	--
0200	23	1	2	--	--	--	--	--	--	1	109	9	78	72	0	--
0300	21	1	3	--	--	--	--	--	--	2	97	5	77	71	0	--
0400	20	1	2	--	--	--	--	--	--	2	104	7	76	70	0	--
0500	14	2	3	--	--	--	--	--	--	1	273	15	75	70	0	--
0600	16	2	2	--	--	--	--	--	--	2	195	6	75	70	0	--
0700	15	23	7	--	--	--	--	--	--	2	56	4	75	70	59	--
0800	24	4	3	--	--	--	--	--	--	3	206	12	79	73	211	--
0900	29	4	3	--	--	--	--	--	--	5	218	17	82	74	423	--
1000	43	4	3	--	--	--	--	--	--	6	222	14	86	76	723	--
1100	39	5	5	--	--	--	--	--	--	6	236	18	89	76	879	--
1200	59	3	2	--	--	--	--	--	--	10	252	12	91	76	1159	--
1300	58	4	3	--	--	--	--	--	--	10	255	11	92	75	1225	--
1400	59	4	3	--	--	--	--	--	--	8	248	16	93	75	1297	--
1500	58	4	2	--	--	--	--	--	--	7	240	19	94	75	1161	--
1600	58	5	3	--	--	--	--	--	--	7	245	19	94	74	1113	--
1700	55	5	9	--	--	--	--	--	--	7	230	16	93	74	974	--
1800	56	5	25	--	--	--	--	--	--	7	234	14	93	75	611	--
1900	52	6	15	--	--	--	--	--	--	5	220	14	92	75	343	--
2000	41	6	12	--	--	--	--	--	--	5	211	10	89	76	146	--
2100	38	5	7	--	--	--	--	--	--	4	215	11	85	74	19	--
2200	30	6	6	--	--	--	--	--	--	3	203	6	82	73	0	--
2300	27	5	5	--	--	--	--	--	--	3	205	5	81	73	0	--
2400	15	3	10	--	--	--	--	--	--	1	150	6	80	72	0	--

TABLE A33 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-19-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	22	4	5	--	--	--	--	--	--	2	102	7	78	71	0	--
0200	12	3	6	--	--	--	--	--	--	1	74	8	76	70	0	--
0300	6	2	7	--	--	--	--	--	--	1	57	5	75	69	0	--
0400	6	1	5	--	--	--	--	--	--	2	257	10	74	68	0	--
0500	12	2	4	--	--	--	--	--	--	2	174	6	73	67	0	--
0600	14	2	5	--	--	--	--	--	--	2	204	8	75	68	5	--
0700	9	15	8	--	--	--	--	--	--	1	111	14	75	70	85	--
0800	19	7	7	--	--	--	--	--	--	2	219	16	79	73	284	--
0900	37	5	5	--	--	--	--	--	--	5	250	12	84	75	558	--
1000	47	5	4	--	--	--	--	--	--	5	254	13	87	75	822	--
1100	56	4	3	--	--	--	--	--	--	8	271	12	90	75	1025	--
1200	66	3	3	--	--	--	--	--	--	8	260	13	91	74	1164	--
1300	67	2	6	--	--	--	--	--	--	7	255	16	92	74	1107	--
1400	67	3	9	--	--	--	--	--	--	7	246	16	93	73	1181	--
1500	67	2	9	--	--	--	--	--	--	7	221	19	94	74	1183	--
1600	67	4	6	--	--	--	--	--	--	6	227	19	93	74	513	--
1700	51	2	11	--	--	--	--	--	--	6	220	13	88	75	159	--
1800	57	0	11	--	--	--	--	--	--	5	232	13	86	74	201	--
1900	48	3	10	--	--	--	--	--	--	4	216	14	84	72	134	--
2000	40	2	9	--	--	--	--	--	--	6	209	7	83	72	55	--
2100	40	2	12	--	--	--	--	--	--	4	194	6	82	70	8	--
2200	36	7	12	--	--	--	--	--	--	2	166	12	80	68	42	--
2300	51	35	4	--	--	--	--	--	--	--	88	--	66	43	370	--
2400	15	1	17	--	--	--	--	--	--	--	225	8	78	70	0	--

TABLE A34 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-20-77

				GAS	DATA							MET.	DATA			
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	17	1	8	--	--	--	--	--	--	4	198	6	77	70	0	--
0200	17	0	8	--	--	--	--	--	--	4	184	6	76	69	0	--
0300	18	0	8	--	--	--	--	--	--	4	188	5	76	68	0	--
0400	17	0	8	--	--	--	--	--	--	2	156	9	75	67	0	--
0500	8	0	11	--	--	--	--	--	--	1	50	6	74	67	0	--
0600	6	7	12	--	--	--	--	--	--	1	61	6	73	67	0	--
0700	9	6	8	--	--	--	--	--	--	3	166	9	73	67	72	--
0800	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
0900	14	4	9	--	--	--	--	--	--	2	166	11	77	69	203	--
1000	19	6	15	--	--	--	--	--	--	2	201	18	66	60	422	--
1100	32	6	8	--	--	--	--	--	--	4	206	16	83	73	606	--
1200	43	3	6	--	--	--	--	--	--	6	204	19	87	72	891	--
1300	46	2	8	--	--	--	--	--	--	8	212	18	89	74	1247	--
1400	50	2	7	--	--	--	--	--	--	10	204	15	90	72	1296	--
1500	50	2	7	--	--	--	--	--	--	10	201	15	91	72	1190	--
1600	51	3	7	--	--	--	--	--	--	10	208	15	91	71	1073	--
1700	50	2	6	--	--	--	--	--	--	11	208	14	91	71	941	--
1800	56	3	8	--	--	--	--	--	--	8	204	12	91	71	818	--
1900	56	0	10	--	--	--	--	--	--	7	188	12	89	71	520	--
2000	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
2100	32	2	11	--	--	--	--	--	--	4	203	8	82	72	18	--
2200	36	1	10	--	--	--	--	--	--	3	203	10	73	67	180	--
2300	31	2	5	--	--	--	--	--	--	3	225	10	79	70	0	--
2400	24	1	5	--	--	--	--	--	--	2	203	8	77	69	2	--

TABLE A35 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-21-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	15	1	8	--	--	--	--	--	--	2	145	6	76	69	0	--
0200	12	4	9	--	--	--	--	--	--	2	54	4	75	68	0	--
0300	13	1	6	--	--	--	--	--	--	3	166	6	74	68	0	--
0400	10	0	5	--	--	--	--	--	--	3	196	5	73	68	0	--
0500	13	0	6	--	--	--	--	--	--	2	208	6	74	68	0	--
0600	13	1	5	--	--	--	--	--	--	3	201	7	73	68	0	--
0700	14	4	8	--	--	--	--	--	--	3	217	11	75	69	45	--
0800	16	5	6	--	--	--	--	--	--	5	224	13	76	70	217	--
0900	22	3	6	--	--	--	--	--	--	4	244	13	79	71	341	--
1000	34	3	5	--	--	--	--	--	--	8	268	12	82	73	712	--
1100	44	2	6	--	--	--	--	--	--	10	270	12	85	74	833	--
1200	49	2	5	--	--	--	--	--	--	9	272	16	87	74	1102	--
1300	45	3	8	--	--	--	--	--	--	6	255	16	84	73	451	--
1400	43	4	6	--	--	--	--	--	--	7	261	11	85	74	1016	--
1500	47	3	6	--	--	--	--	--	--	8	263	15	90	75	1256	--
1600	49	3	6	--	--	--	--	--	--	9	250	12	90	73	1112	--
1700	48	4	6	--	--	--	--	--	--	9	264	12	89	72	426	--
1800	51	0	2	--	--	--	--	--	--	12	271	9	80	71	182	--
1900	38	4	8	--	--	--	--	--	--	4	205	18	83	73	210	--
2000	36	1	5	--	--	--	--	--	--	6	256	8	81	73	73	--
2100	26	0	6	--	--	--	--	--	--	4	49	3	81	72	0	--
2200	24	0	9	--	--	--	--	--	--	3	51	--	79	70	0	--
2300	18	1	7	--	--	--	--	--	--	2	71	5	75	70	46	--
2400	21	1	8	--	--	--	--	--	--	1	267	12	74	69	0	--

TABLE A36 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-22-77

	GAS	DATA								MET.	DATA					
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	10	0	9	--	--	--	--	--	--	4	109	10	75	70	0	--
0200	17	0	7	--	--	--	--	--	--	7	51	1	76	70	0	--
0300	16	0	6	--	--	--	--	--	--	6	50	--	75	70	0	--
0400	18	0	6	--	--	--	--	--	--	7	51	1	76	70	0	--
0500	16	0	5	--	--	--	--	--	--	8	51	1	76	70	0	--
0600	17	1	6	--	--	--	--	--	--	10	51	1	76	68	0	--
0700	21	0	5	--	--	--	--	--	--	12	52	--	75	67	33	--
0800	20	0	4	--	--	--	--	--	--	12	51	--	74	64	93	--
0900	19	0	3	--	--	--	--	--	--	13	51	--	75	62	212	--
1000	21	0	2	--	--	--	--	--	--	14	50	--	76	61	628	--
1100	26	1	2	--	--	--	--	--	--	15	49	--	79	58	1023	--
1200	34	1	1	--	--	--	--	--	--	15	52	1	82	58	1221	--
1300	40	1	2	--	--	--	--	--	--	15	53	3	84	57	1306	--
1400	43	0	3	--	--	--	--	--	--	16	54	1	85	56	1336	--
1500	39	0	5	--	--	--	--	--	--	7	118	1	48	37	920	--
1600	58	0	4	--	--	--	--	--	--	--	269	1	22	24	1146	--
1700	60	0	5	--	--	--	--	--	--	--	359	1	21	24	958	--
1800	54	--	3	--	--	--	--	--	--	--	357	1	21	24	798	--
1900	42	13	4	--	--	--	--	--	--	4	6	1	22	23	208	--
2000	49	0	6	--	--	--	--	--	--	1	355	1	21	24	124	--
2100	41	0	6	--	--	--	--	--	--	--	356	1	21	23	0	--
2200	23	4	11	--	--	--	--	--	--	--	357	--	22	23	0	--
2300	4	23	26	--	--	--	--	--	--	--	358	--	22	23	0	--
2400	8	8	16	--	--	--	--	--	--	--	358	--	22	23	0	--

TABLE A37 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-23-77

Time	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	9	2	11	--	--	--	--	--	--	--	358	--	22	23	0	--
0200	23	0	6	--	--	--	--	--	--	--	358	--	22	23	0	--
0300	23	0	6	--	--	--	--	--	--	--	358	--	22	23	0	--
0400	23	0	5	--	--	--	--	--	--	--	358	--	22	23	0	--
0500	23	0	5	--	--	--	--	--	--	--	356	--	22	23	0	--
0600	17	0	5	--	--	--	--	--	--	--	356	1	21	23	0	--
0700	14	1	7	--	--	--	--	--	--	--	356	1	21	23	100	--
0800	21	1	6	--	--	--	--	--	--	--	357	1	21	23	366	--
0900	24	5	10	--	--	--	--	--	--	1	356	1	21	24	628	--
1000	28	6	10	--	--	--	--	--	--	--	359	1	21	24	877	--
1100	35	4	13	--	--	--	--	--	--	--	357	1	21	24	1046	--
1200	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1300	64	--	7	--	--	--	--	--	--	--	357	1	22	24	1315	--
1400	66	1	6	--	--	--	--	--	--	--	181	1	22	24	1321	--
1500	66	0	5	--	--	--	--	--	--	--	357	1	21	24	1248	--
1600	65	2	7	--	--	--	--	--	--	--	357	1	21	24	1101	--
1700	66	1	8	--	--	--	--	--	--	--	180	1	22	24	882	--
1800	64	3	7	--	--	--	--	--	--	--	240	1	22	24	650	--
1900	64	2	7	--	--	--	--	--	--	--	357	1	21	24	384	--
2000	55	2	11	--	--	--	--	--	--	--	357	1	21	24	123	--
2100	44	3	11	--	--	--	--	--	--	--	356	1	21	24	0	--
2200	33	4	9	--	--	--	--	--	--	--	357	1	21	24	0	--
2300	36	4	10	--	--	--	--	--	--	1	356	1	21	23	0	--
2400	12	13	26	--	--	--	--	--	--	1	355	1	20	24	0	--

TABLE A38. SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-24-77

	GAS DATA									MET. DATA						
Time hr	O_3 ppb	NO ppb	NO_2 ppb	NMTHC ppmC	CO ppm	CH_4 ppm	$CFCl_3$ ppt	CCl_4 ppt	CH_3CCl_3 ppt	WS knt	WD deg	σ_θ deg	TMP °F	DP °F	RAD mLy	BARO "Hg
0100	4	24	24	--	--	--	--	--	--	1	354	1	21	23	0	--
0200	2	21	21	--	--	--	--	--	--	1	355	1	21	23	0	--
0300	3	6	19	--	--	--	--	--	--	1	354	1	21	23	0	--
0400	2	5	16	--	--	--	--	--	--	--	356	1	21	23	0	--
0500	2	6	13	--	--	--	--	--	--	1	356	1	21	24	0	--
0600	2	7	13	--	--	--	--	--	--	1	354	1	21	23	0	--
0700	5	10	13	--	--	--	--	--	--	1	354	1	21	23	98	--
0800	14	4	9	--	--	--	--	--	--	1	356	1	21	23	183	--
0900	40	2	7	--	--	--	--	--	--	1	356	1	21	24	576	--
1000	49	2	7	--	--	--	--	--	--	1	355	1	21	24	754	--
1100	56	2	12	--	--	--	--	--	--	1	356	1	20	24	884	--
1200	77	1	10	--	--	--	--	--	--	1	353	1	21	24	1155	--
1300	73	0	7	--	--	--	--	--	--	--	356	1	21	24	1188	--
1400	69	1	5	--	--	--	--	--	--	--	356	1	22	23	1196	--
1500	68	--	6	--	--	--	--	--	--	--	357	1	21	24	826	--
1600	67	1	4	--	--	--	--	--	--	--	357	1	21	24	880	--
1700	66	1	6	--	--	--	--	--	--	--	356	1	21	24	735	--
1800	72	1	7	--	--	--	--	--	--	--	267	1	21	24	391	--
1900	55	2	6	--	--	--	--	--	--	1	240	1	22	27	198	--
2000	56	1	8	--	--	--	--	--	--	--	356	1	21	23	76	--
2100	48	1	6	--	--	--	--	--	--	--	357	1	21	24	0	--
2200	42	1	6	--	--	--	--	--	--	--	357	1	21	24	0	--
2300	33	0	8	--	--	--	--	--	--	--	356	1	21	23	0	--
2400	35	0	7	--	--	--	--	--	--	--	357	1	21	23	0	--

TABLE A39 . SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-25-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	42	0	4	--	--	--	--	--	--	--	357	1	21	24	0	--
0200	39	0	5	--	--	--	--	--	--	--	357	1	21	24	0	--
0300	39	0	5	--	--	--	--	--	--	--	357	1	21	23	0	--
0400	35	0	6	--	--	--	--	--	--	--	356	1	21	24	0	--
0500	30	0	6	--	--	--	--	--	--	--	356	1	21	24	0	--
0600	16	1	8	--	--	--	--	--	--	--	357	1	21	24	0	--
0700	17	4	12	--	--	--	--	--	--	--	356	1	21	23	48	--
0800	21	3	8	--	--	--	--	--	--	--	180	1	22	24	76	--
0900	18	4	8	--	--	--	--	--	--	--	359	1	22	23	164	--
1000	20	4	7	--	--	--	--	--	--	--	268	0	22	23	402	--
1100	33	--	6	--	--	--	--	--	--	--	358	--	22	23	456	--
1200	34	1	7	--	--	--	--	--	--	--	180	--	21	23	392	--
1300	39	0	5	--	--	--	--	--	--	--	268	1	21	24	639	--
1400	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1500	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1600	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1700	58	0	3	--	--	--	--	--	--	--	356	1	21	24	685	--
1800	55	0	3	--	--	--	--	--	--	--	270	1	22	23	578	--
1900	43	0	7	--	--	--	--	--	--	--	357	1	21	23	391	--
2000	35	0	9	--	--	--	--	--	--	--	267	1	21	23	130	--
2100	35	0	6	--	--	--	--	--	--	--	269	1	22	23	0	--
2200	23	0	12	--	--	--	--	--	--	1	354	1	21	23	0	--
2300	25	0	6	--	--	--	--	--	--	--	356	1	21	23	0	--
2400	17	0	9	--	--	--	--	--	--	--	357	--	22	23	0	--

TABLE A40. SURFACE DATA COLLECTED AT THE WSU FIELD LABORATORY ON 7-26-77

	GAS DATA									MET. DATA						
Time	O_3	NO	NO_2	NMTHC	CO	CH_4	$CFCl_3$	CCl_4	CH_3CCl_3	WS	WD	σ_θ	TMP	DP	RAD	BARO
hr	ppb	ppb	ppb	ppmC	ppm	ppm	ppt	ppt	ppt	knt	deg	deg	°F	°F	mLy	"Hg
0100	14	0	7	--	--	--	--	--	--	--	359	--	22	23	0	--
0200	15	0	5	--	--	--	--	--	--	--	358	--	22	23	0	--
0300	13	--	6	--	--	--	--	--	--	--	358	--	22	23	0	--
0400	11	0	6	--	--	--	--	--	--	--	239	--	22	23	0	--
0500	10	0	9	--	--	--	--	--	--	--	258	--	22	23	0	--
0600	11	0	9	--	--	--	--	--	--	--	356	1	21	23	0	--
0700	12	1	9	--	--	--	--	--	--	1	356	1	21	23	123	--
0800	19	1	5	--	--	--	--	--	--	--	270	1	22	23	397	--
0900	23	2	4	--	--	--	--	--	--	--	356	1	21	23	664	--
1000	26	1	3	--	--	--	--	--	--	--	357	--	22	23	884	--
1100	28	0	2	--	--	--	--	--	--	--	269	--	22	23	1099	--
1200	35	0	2	--	--	--	--	--	--	--	269	--	22	23	1262	--
1300	43	0	2	--	--	--	--	--	--	--	179	0	22	23	1350	--
1400	46	0	2	--	--	--	--	--	--	--	357	1	21	23	1356	--
1500	47	0	2	--	--	--	--	--	--	0	179	1	22	23	1303	--
1600	44	0	3	--	--	--	--	--	--	1	120	1	22	24	1209	--
1700	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
1800	24	7	9	--	--	--	--	--	--	5	182	1	25	24	316	--
1900	42	0	3	--	--	--	--	--	--	--	356	1	21	23	400	--
2000	42	0	2	--	--	--	--	--	--	1	356	1	21	23	167	--
2100	38	0	3	--	--	--	--	--	--	1	355	1	20	23	0	--
2200	33	0	4	--	--	--	--	--	--	--	355	1	21	23	0	--
2300	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--
2400	--	--	--	--	--	--	--	--	--	--	---	--	--	--	---	--

APPENDIX B

Flight paths for each mission and vertical profiles of O_3 and temperature recorded during aircraft spirals are given in Appendix B.

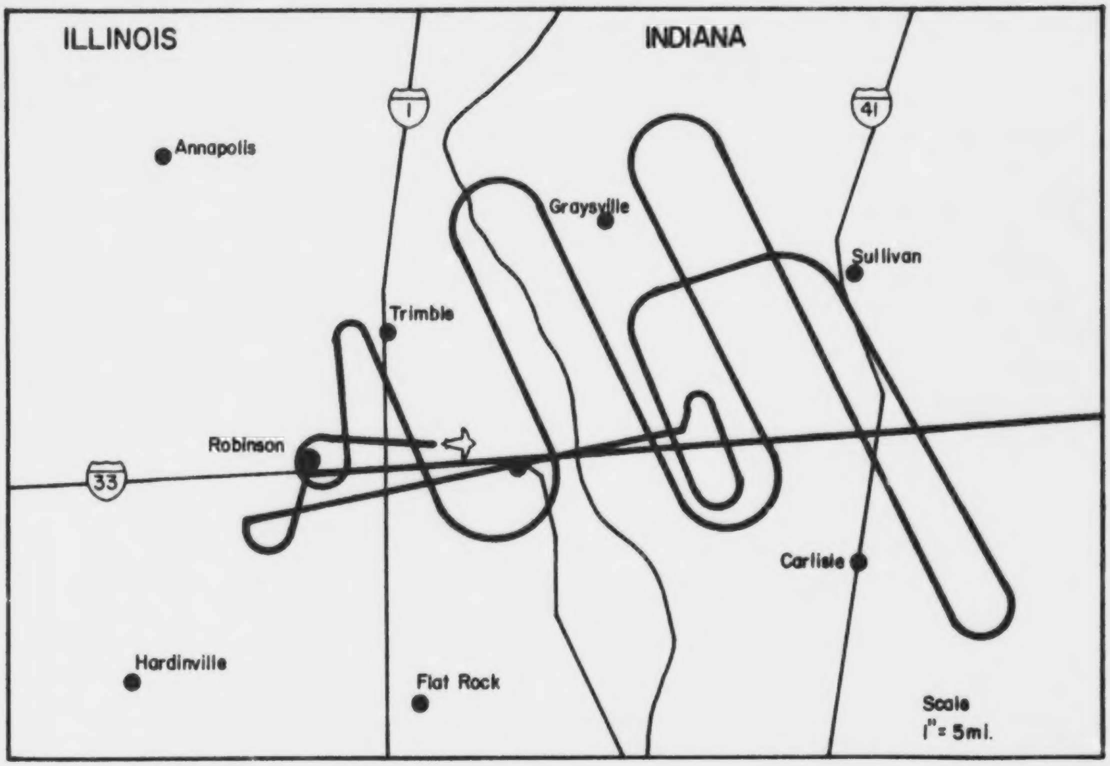
ILLINOIS
INDIANA
1
41
Annapolis
Graysville
Sullivan
Trimble
Robinson
33
Carlisle
Hardinville
Flat Rock
Scale
1" = 5 mi.

Figure B1. Flight path on June 20, 1977 (0915-1145 CDT)

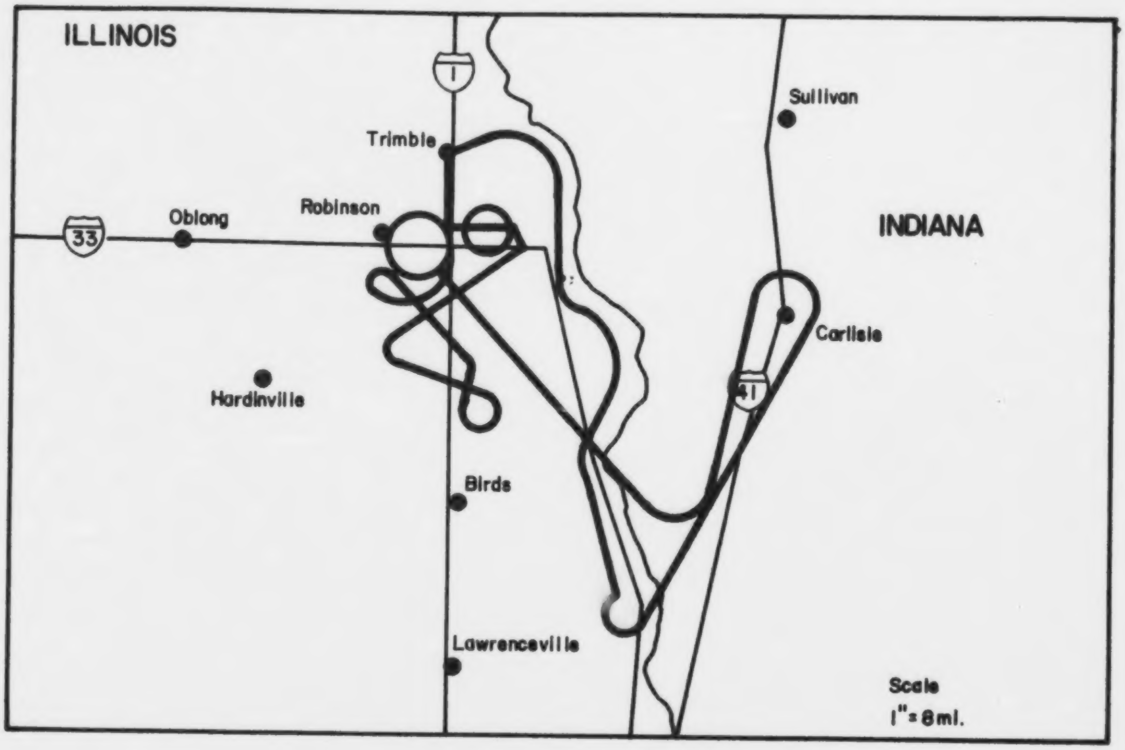
ILLINOIS
1
Sullivan
Trimble
Robinson
Oblong
33
INDIANA
Carlisle
41
Hardinville
Birds
Lawrenceville
Scale
1" = 8 mi.

Figure B2. Flight path on June 20, 1977 (1650-1845 CDT)

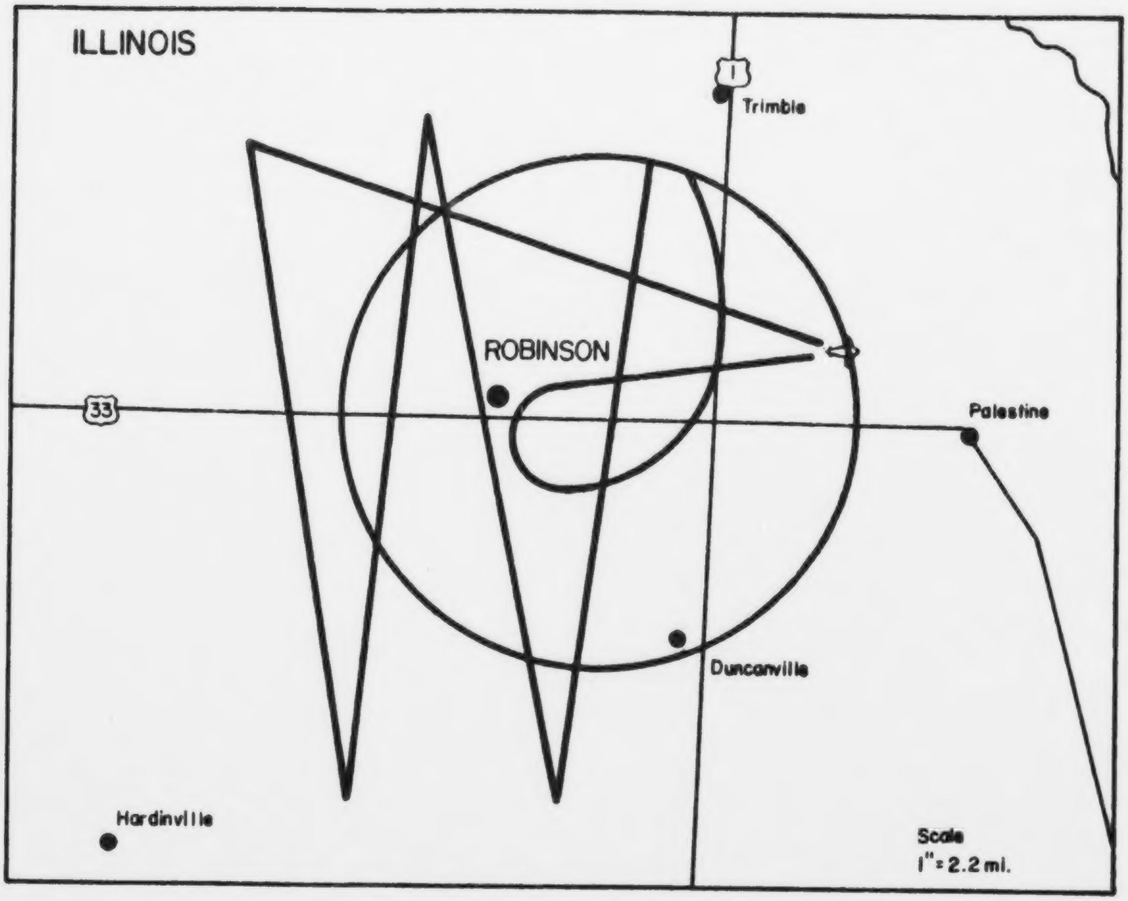
ILLINOIS
1
Trimble
ROBINSON
33
Palestine
Duncanville
Hardinville
Scale
1" = 2.2 mi.

Figure B3. Flight path on June 21, 1977 (1015-1130 CDT)

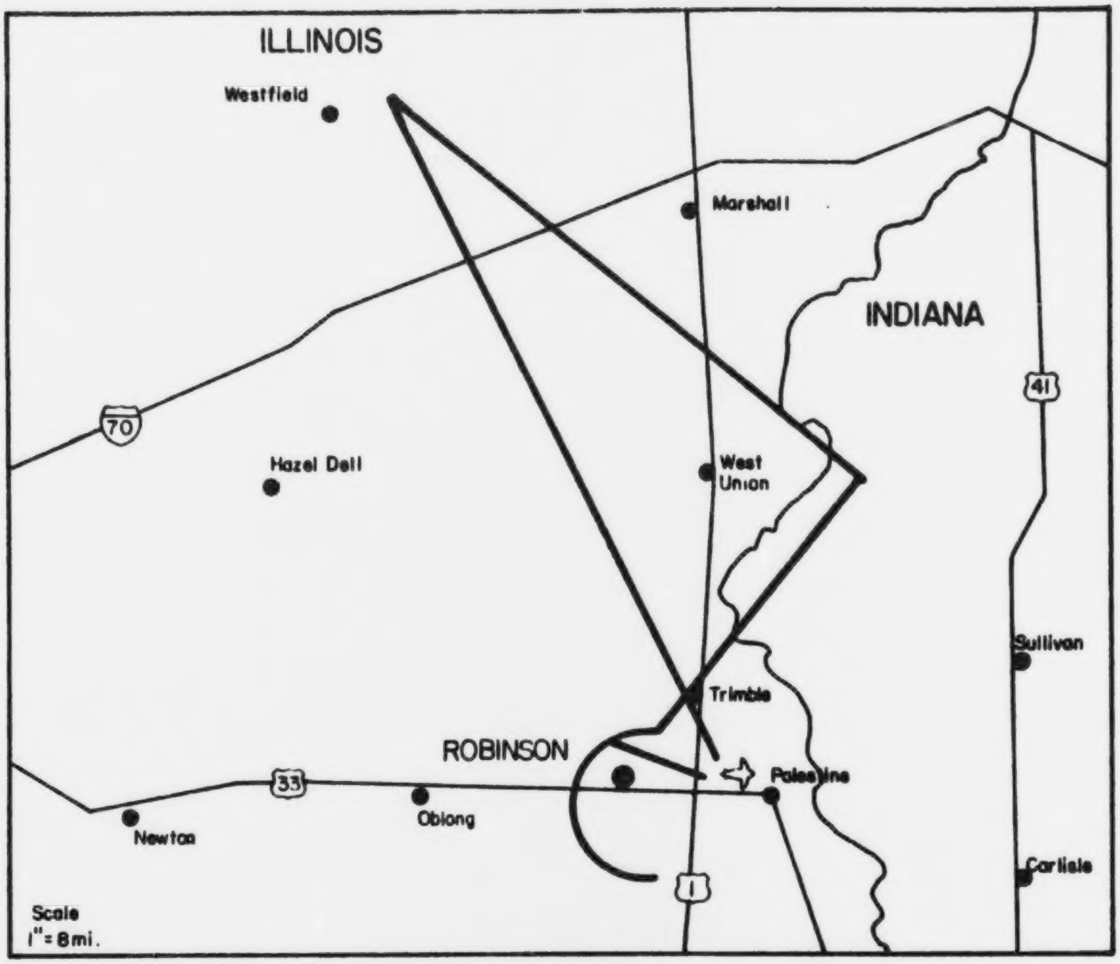
ILLINOIS
Westfield
Marshall
INDIANA
70
41
Hazel Dell
West Union
Sullivan
Trimble
ROBINSON
Palestine
33
Newton
Oblong
Carlisle
1
Scale
1" = 8mi.

Figure B4 Flight path on June 21, 1977 (1810-2030 CDT)

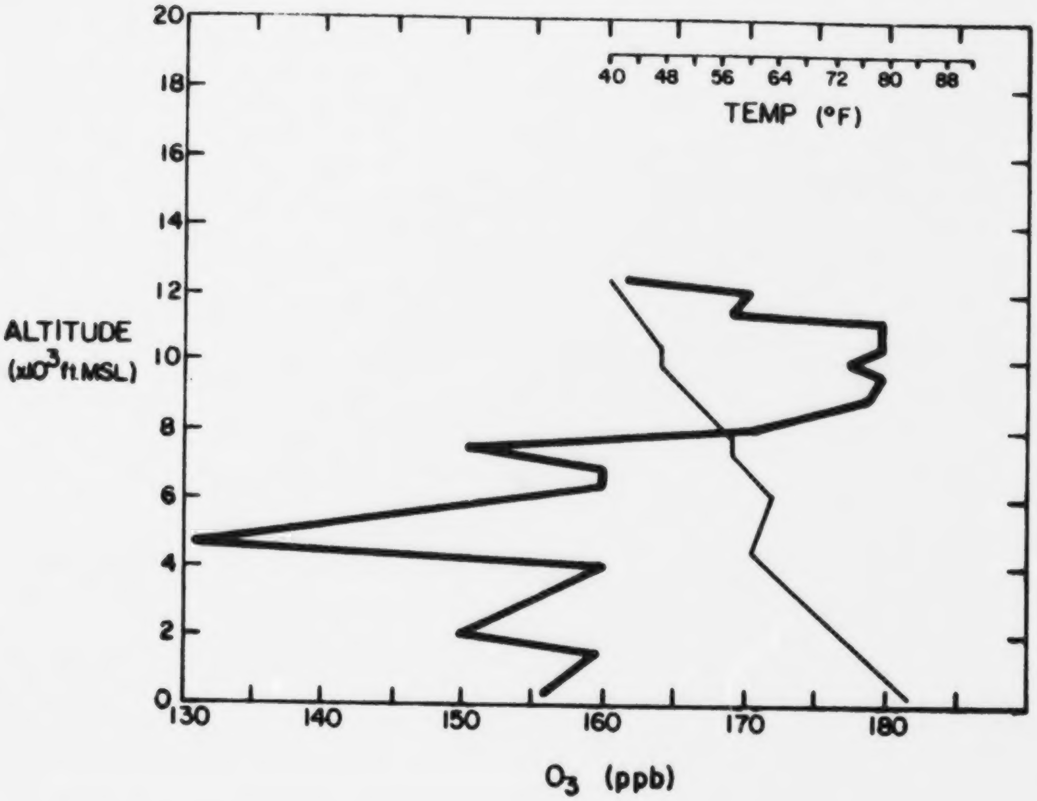

Figure B5. Vertical ozone and temperature profiles at 1831 on June 21, 1977.

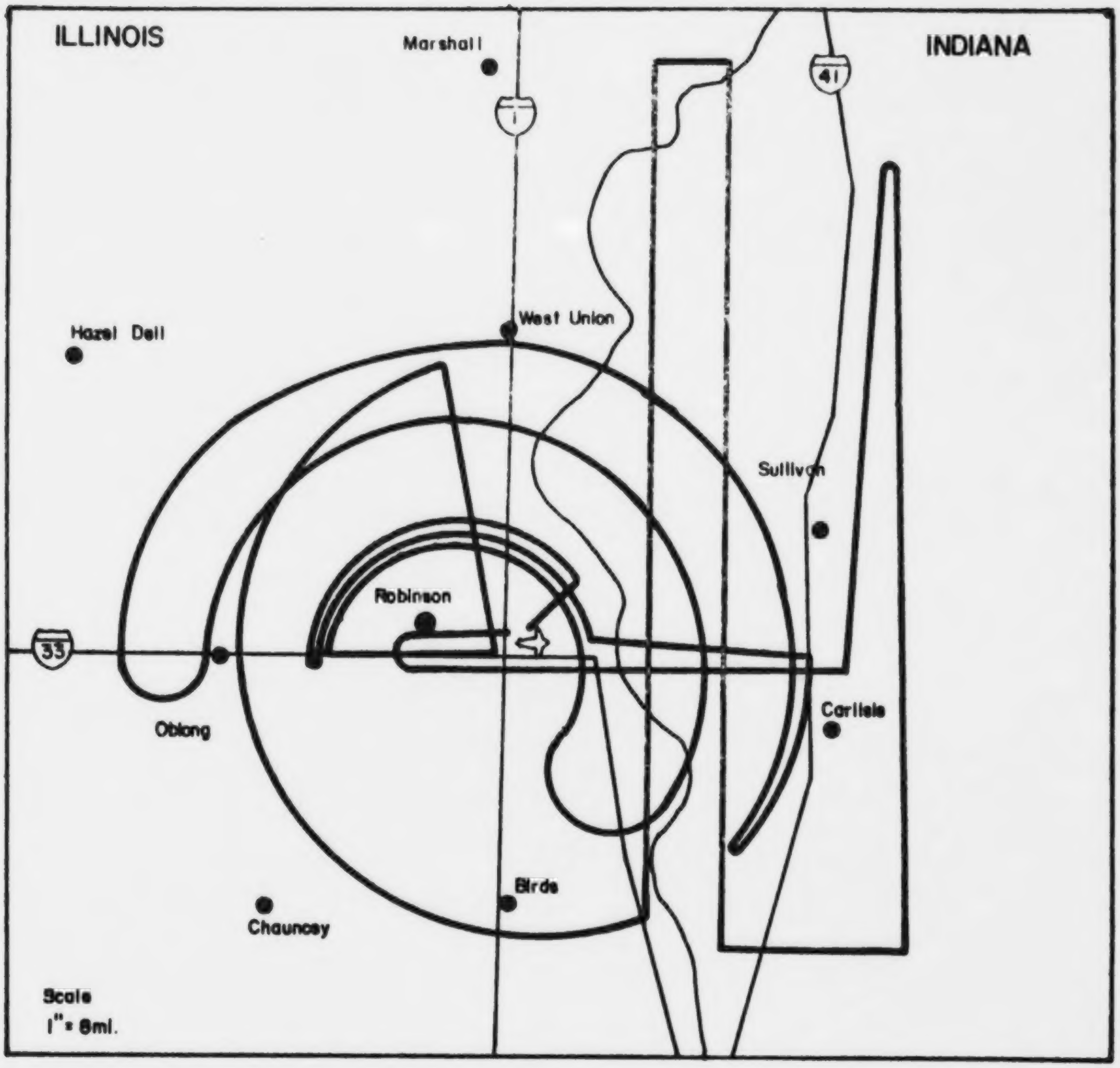
ILLINOIS
Marshall
INDIANA
41
1
Hazel Dell
West Union
Sullivan
Robinson
33
Oblong
Carlisle
Birds
Chauncey
Scale
1" = 8mi.

Figure B6. Flight path on July 8, 1977 (1045-1415 CDT)

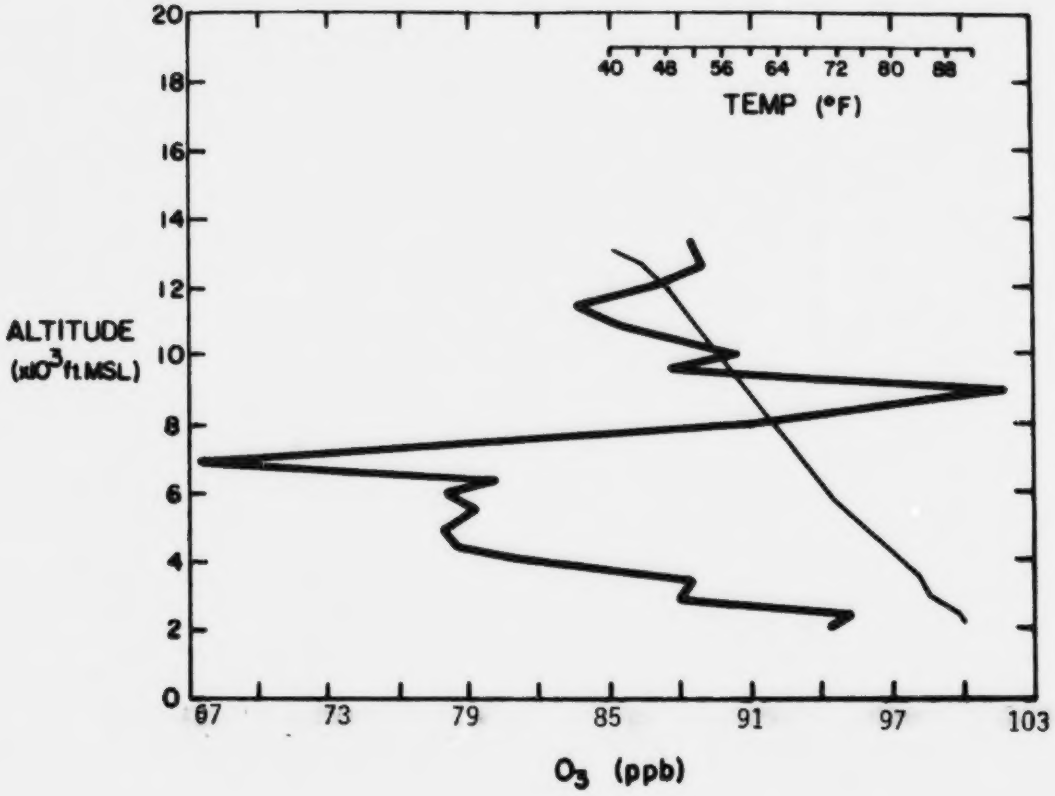

Figure B7 Vertical ozone and temperature profiles at 1146 on July 8, 1977.

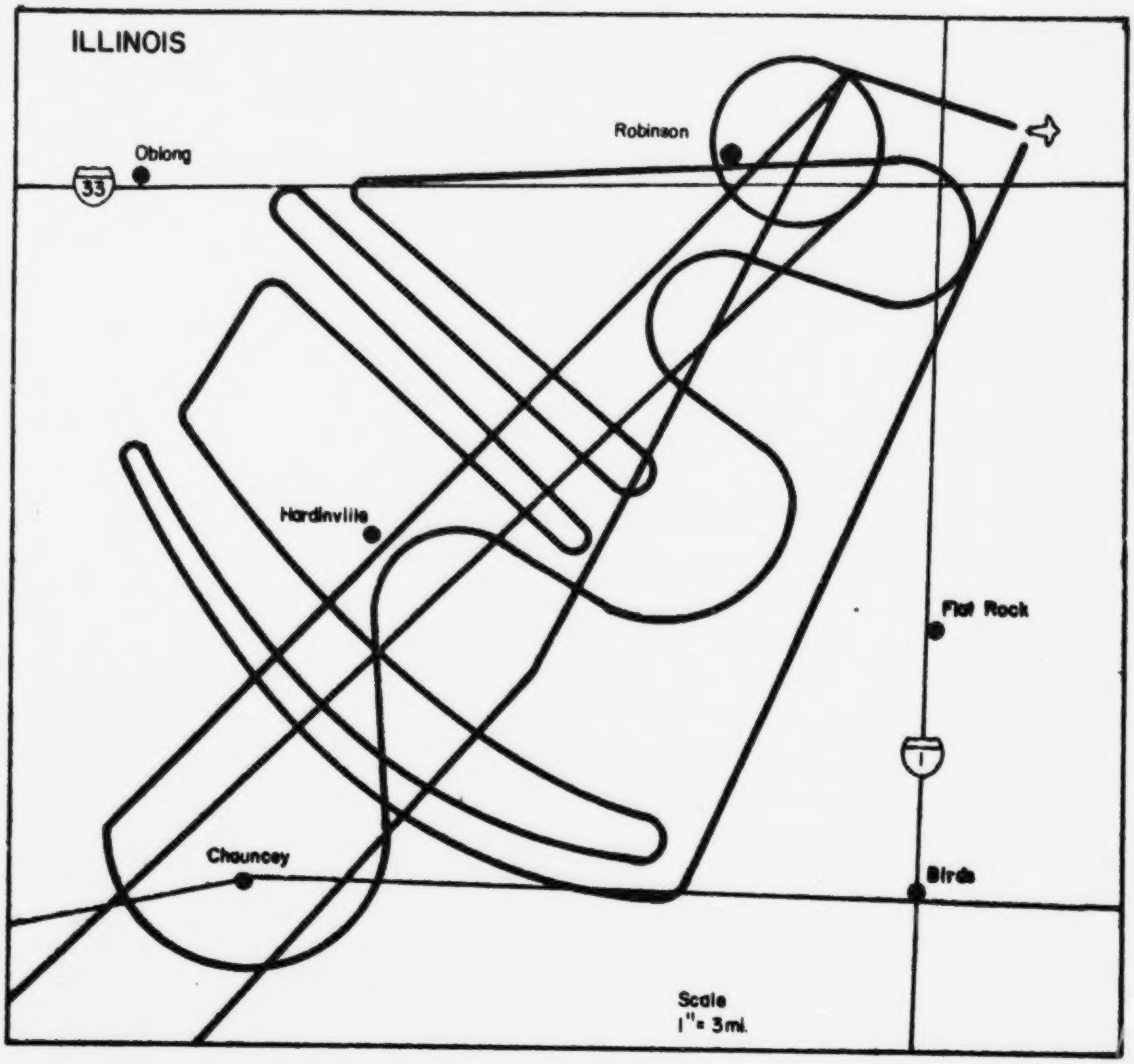
ILLINOIS
Robinson
Oblong
33
Hardinville
Flat Rock
1
Chauncey
Birds
Scale
1" = 3mi.

Figure B8. Flight path on July 9, 1977 (0745-1005 CDT)

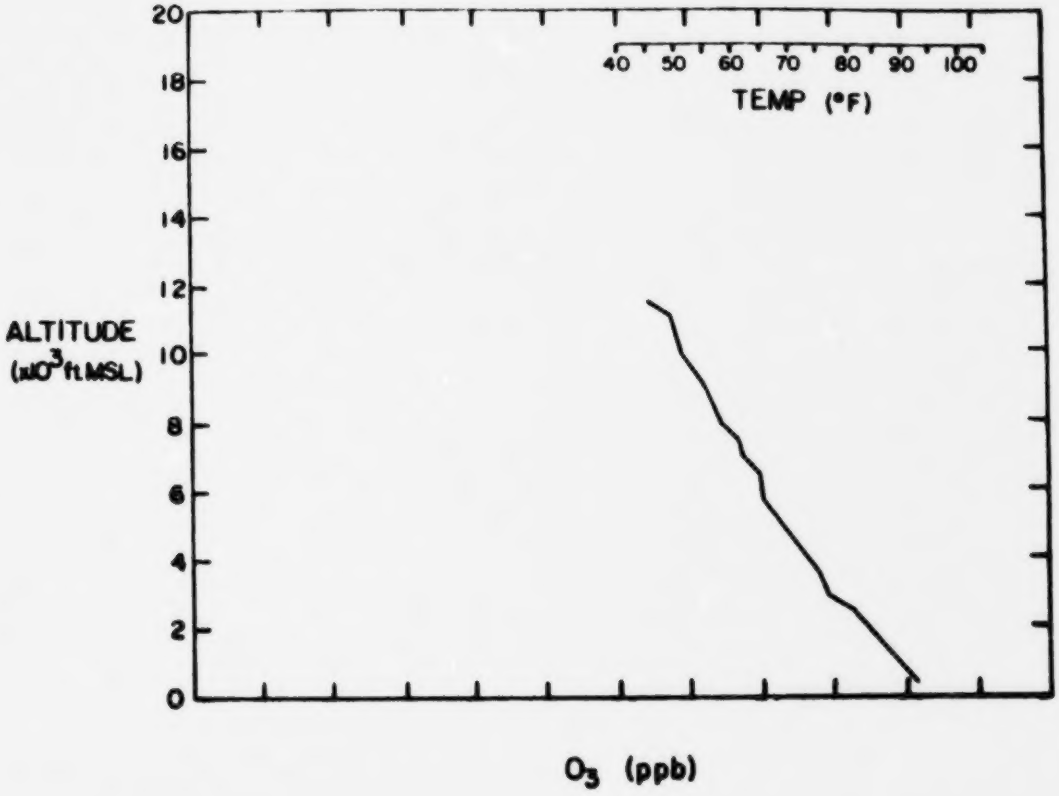

Figure B9. Vertical temperature profile at 1404 on July 9, 1977.

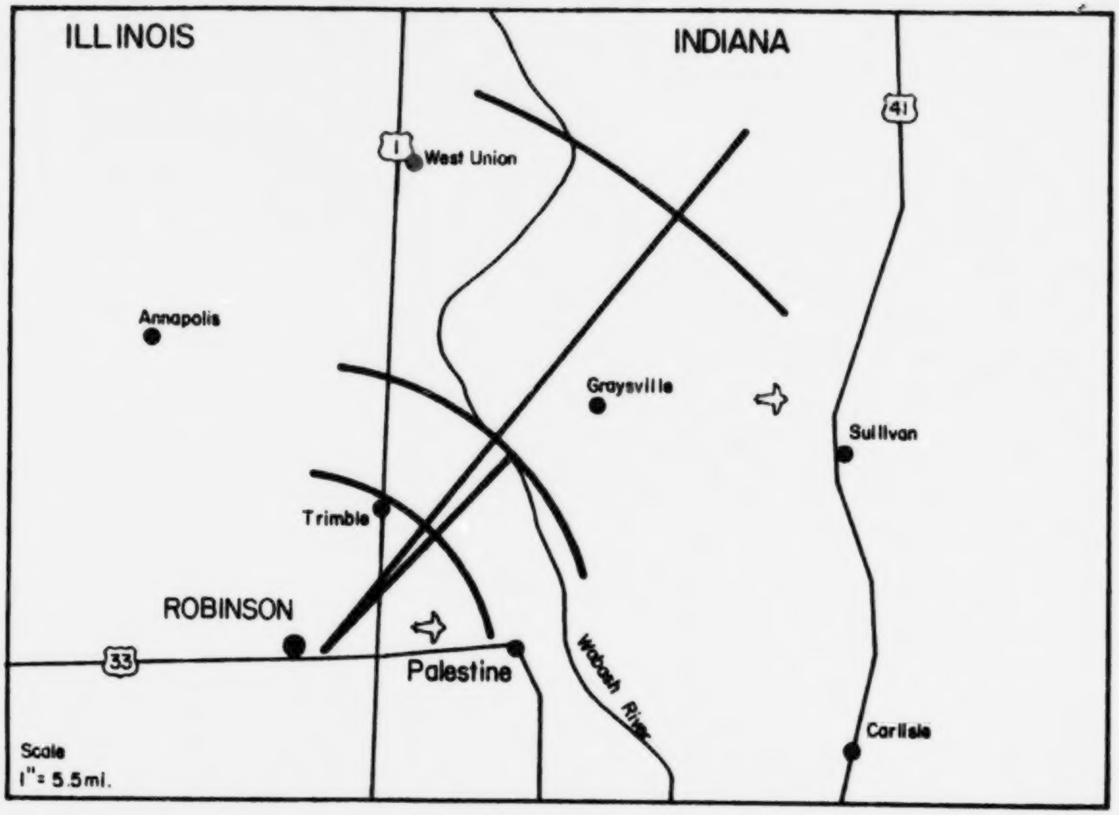
ILLINOIS
INDIANA
41
1
West Union
Annapolis
Graysville
Sullivan
Trimble
ROBINSON
33
Palestine
Wabash River
Carlisle
Scale
1" = 5.5 mi.

Figure B10. Flight path on July 11, 1977 (1715-1900 CDT)

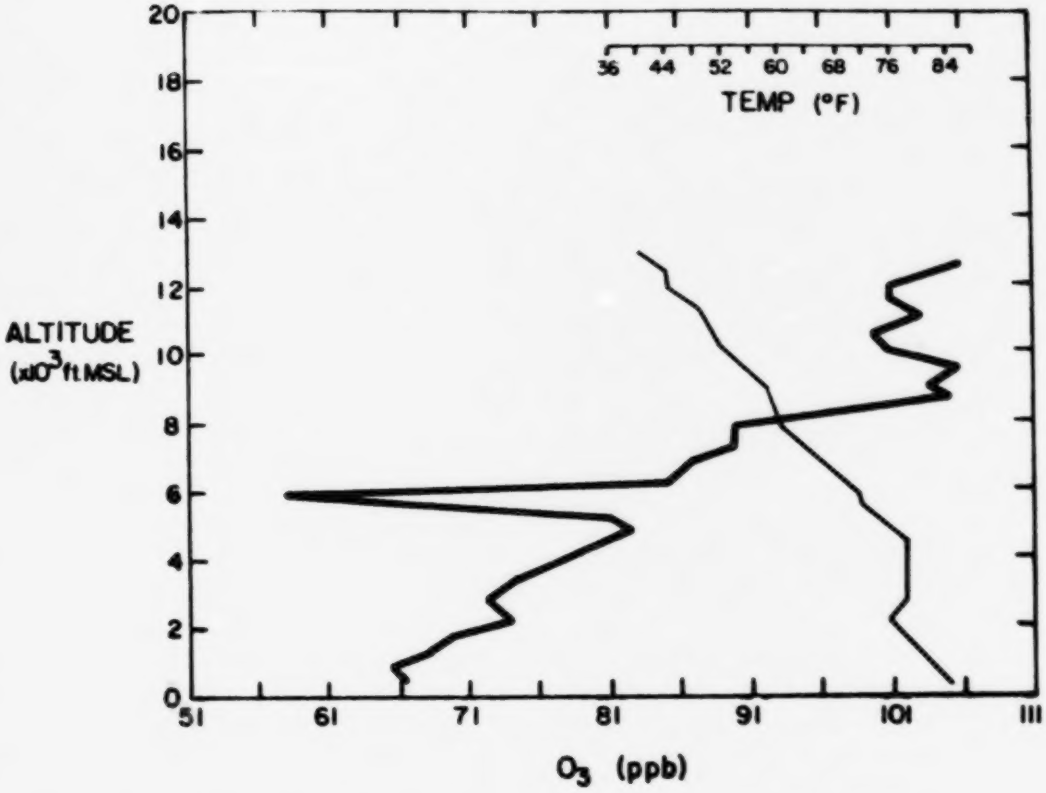

Figure B11. Vertical ozone and temperature profiles at 1736 on July 11, 1977.

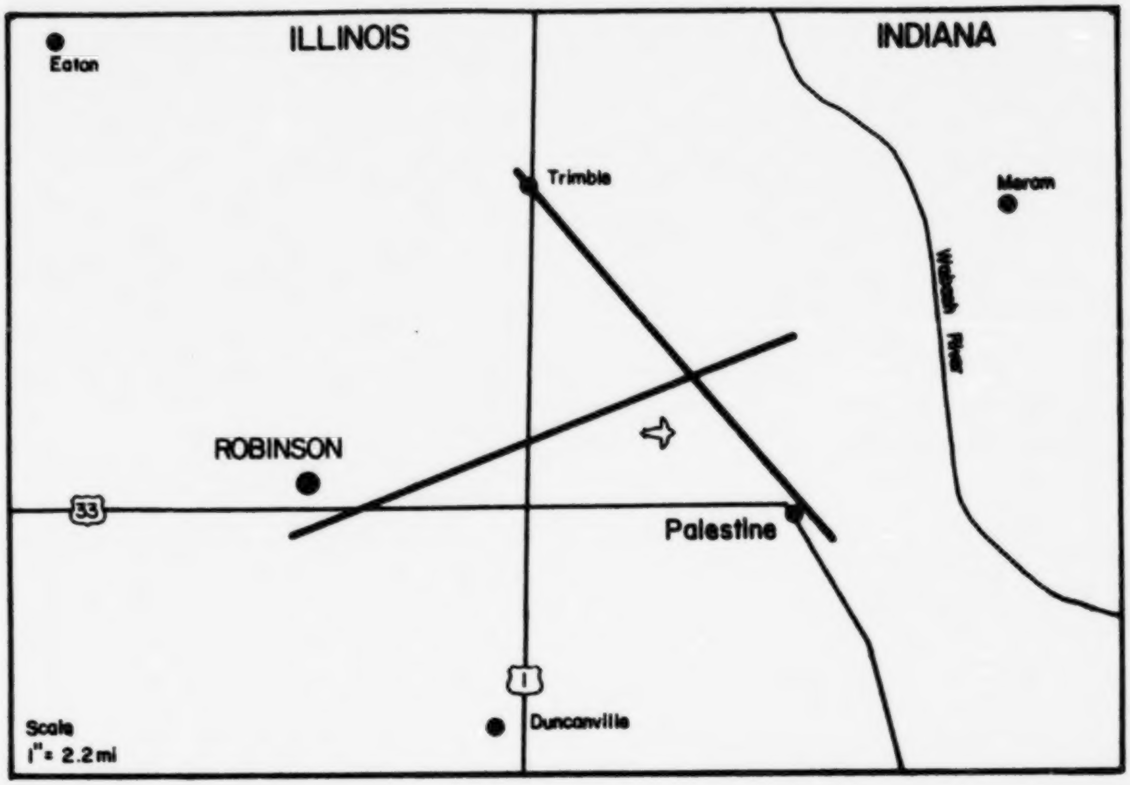
ILLINOIS
INDIANA
Eaton
Trimble
Meram
Wabash River
ROBINSON
33
Palestine
1
Duncanville
Scale
1" = 2.2 mi

Figure B12.Flight path on July 12, 1977 (1023-1150 CDT)

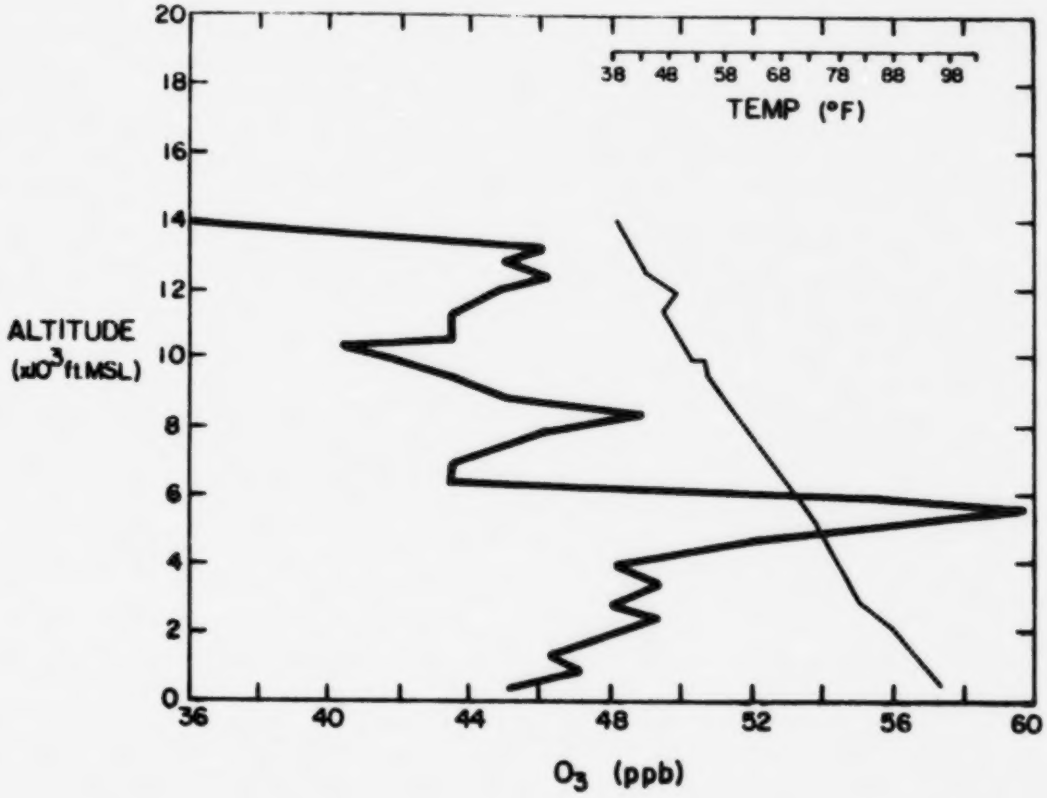

Figure B13. Vertical ozone and temperature profiles at 1023 on July 12, 1977.

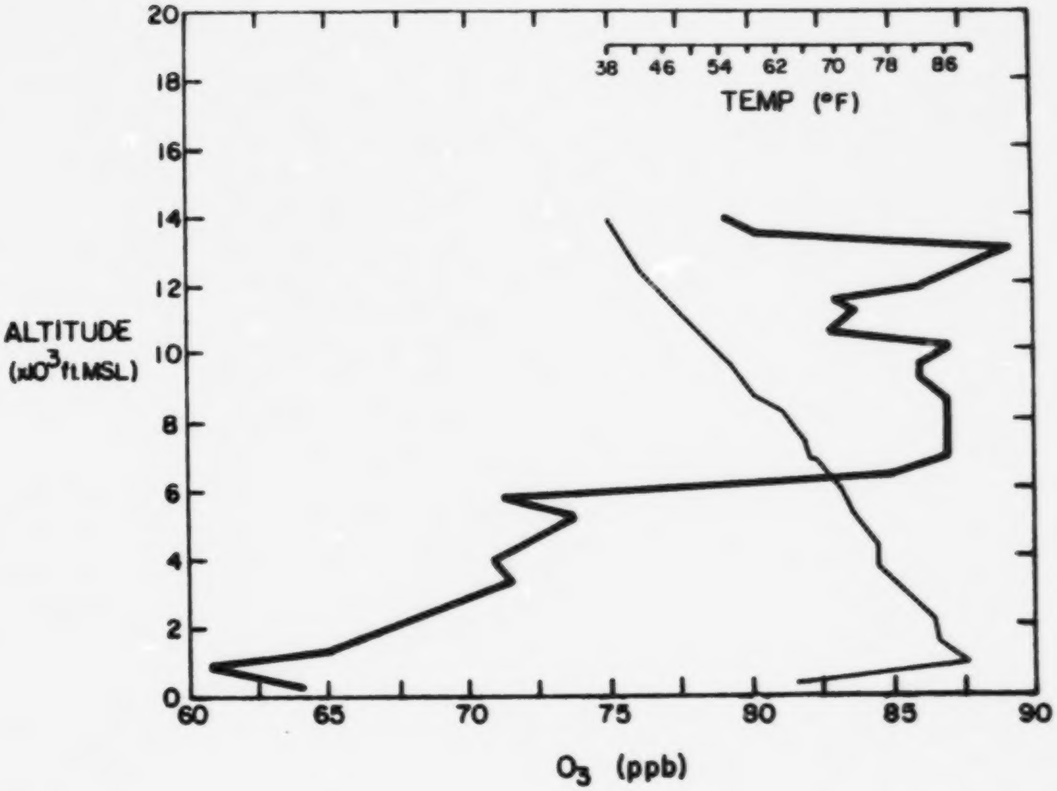

Figure B14. Vertical ozone and temperature profiles at 1047 on July 12, 1977.

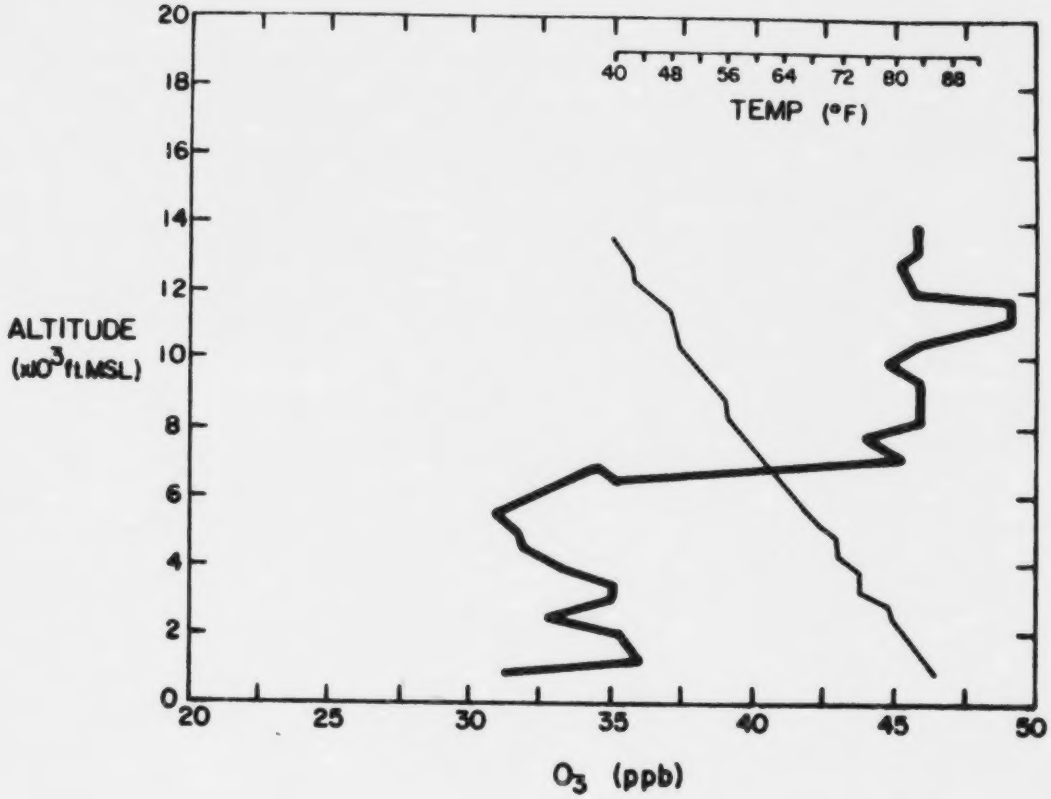

Figure B15 Vertical ozone and temperature profiles at 0640 on July 14, 1977.

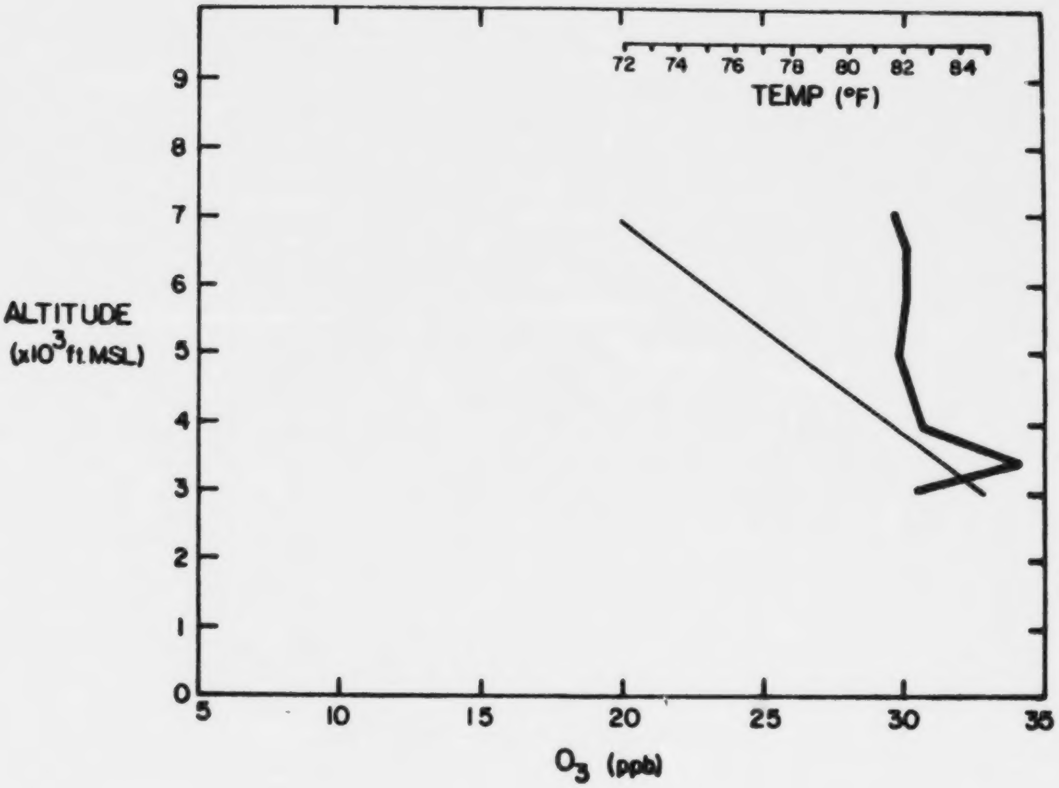

Figure B16. Vertical ozone and temperature profiles at 1339 on July 14, 1977.

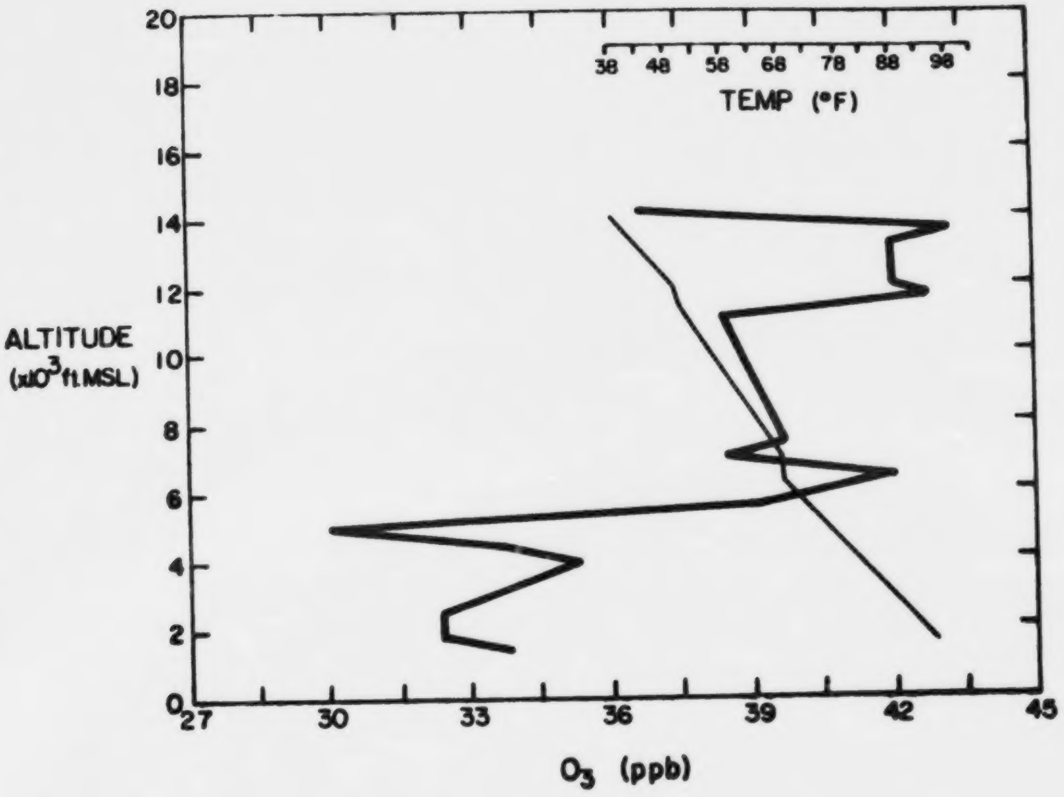

Figure B17. Vertical ozone and temperature profiles at 1930 on July 18, 1977.

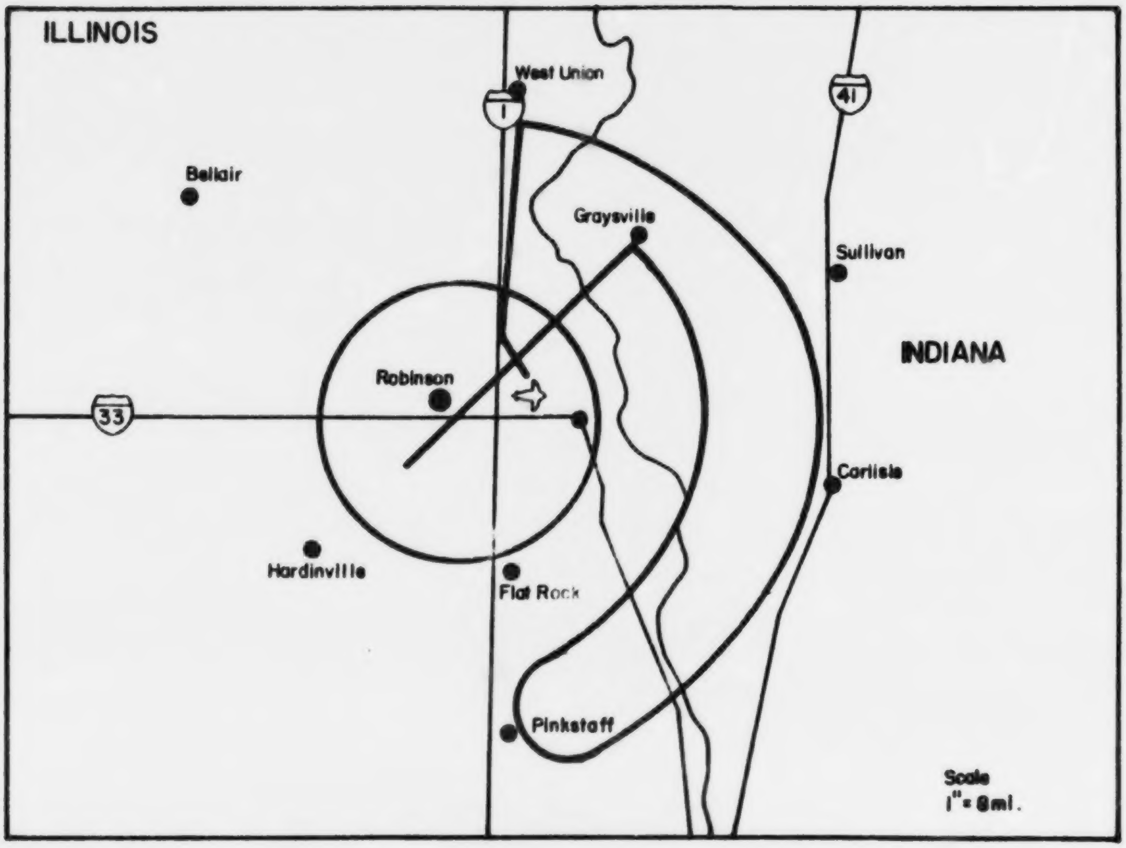
ILLINOIS
West Union
1
41
Bellair
Graysville
Sullivan
INDIANA
Robinson
33
Carlisle
Hardinville
Flat Rock
Pinkstaff
Scale
1" = 8mi.

Figure B18. Flight path on July 19, 1977 (1112-1254 CDT)

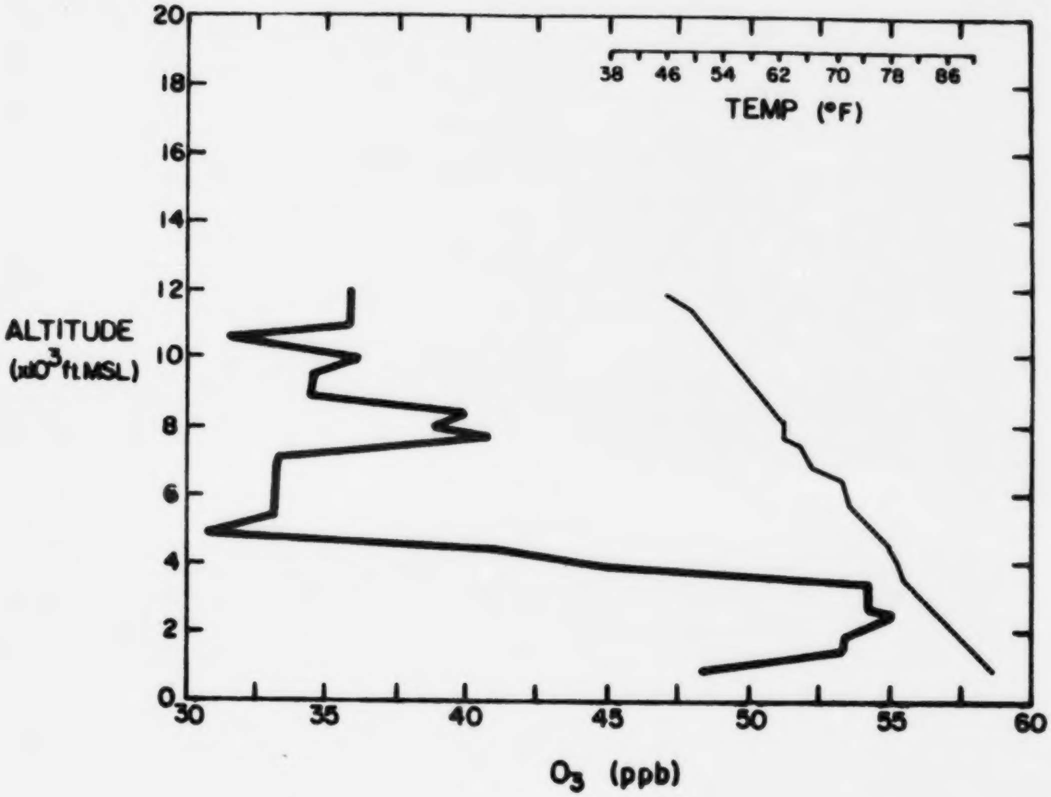

Figure B19. Vertical ozone and temperature profiles at 2205 on July 19, 1977.

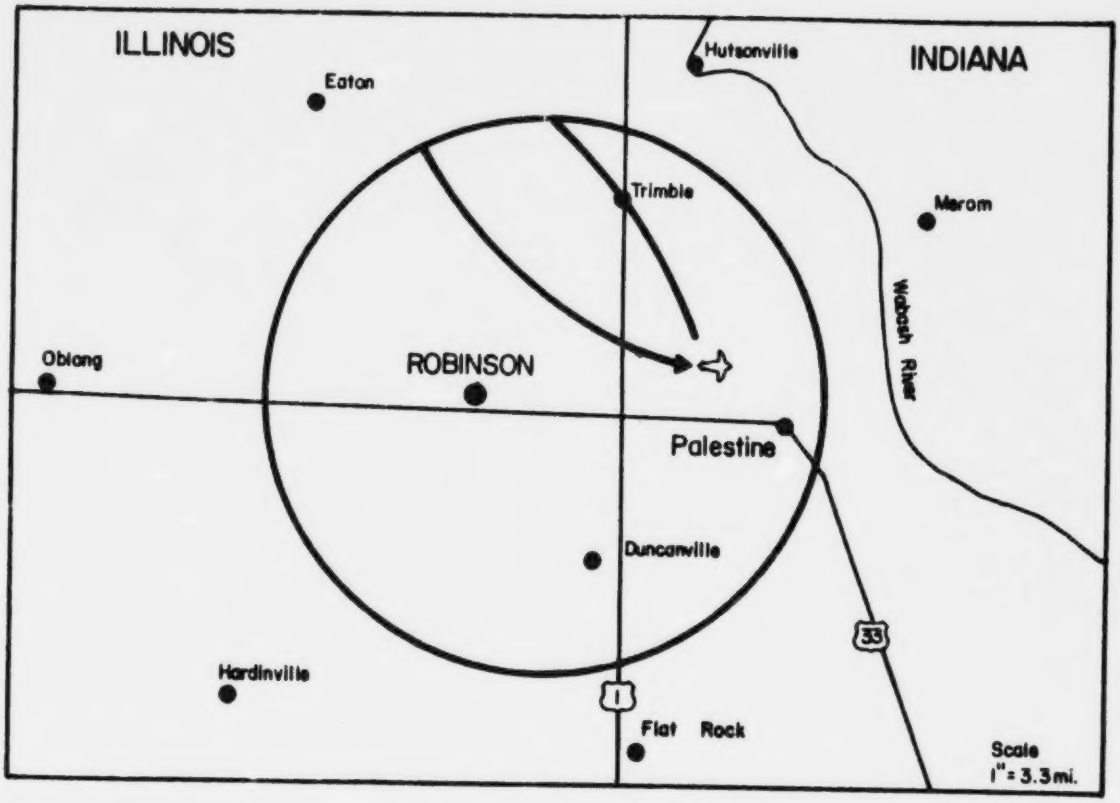
ILLINOIS
INDIANA
Eaton
Hutsonville
Trimble
Merom
Wabash River
Oblong
ROBINSON
Palestine
Duncanville
Hardinville
1
33
Flat Rock
Scale
1" = 3.3 mi.

Figure B20. Flight path on July 20, 1977 (0630-0730 CDT)

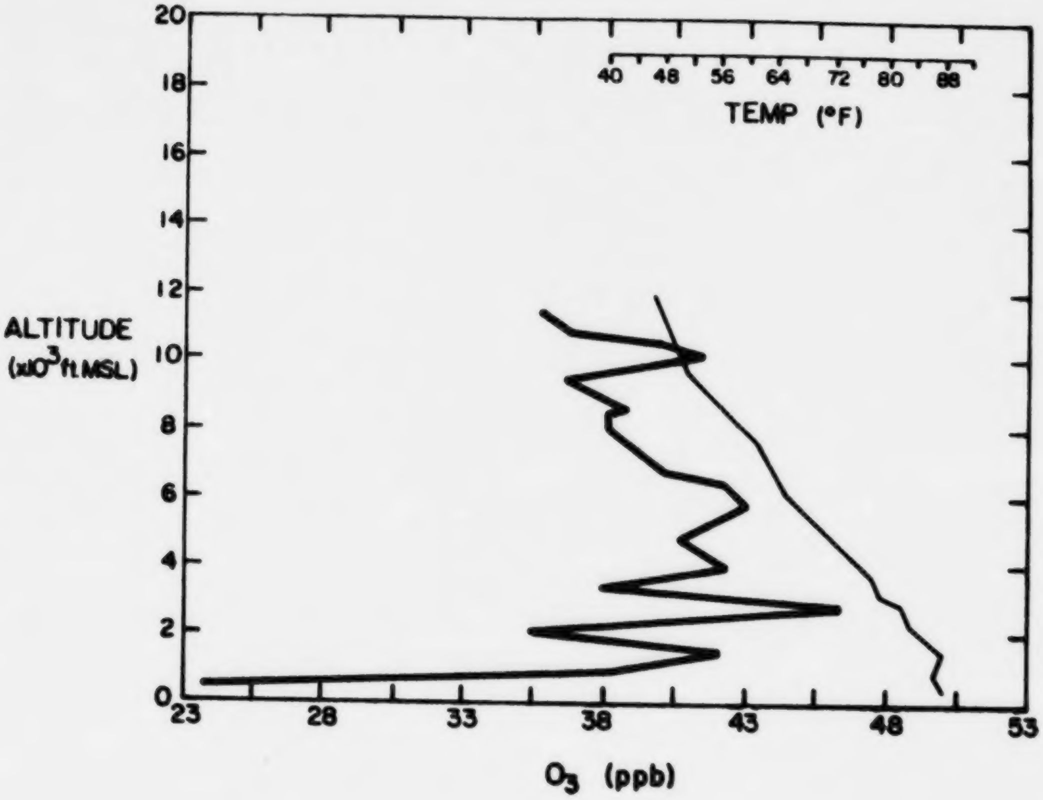

Figure B21. Vertical ozone and temperature profiles at 0642 on July 20, 1977.

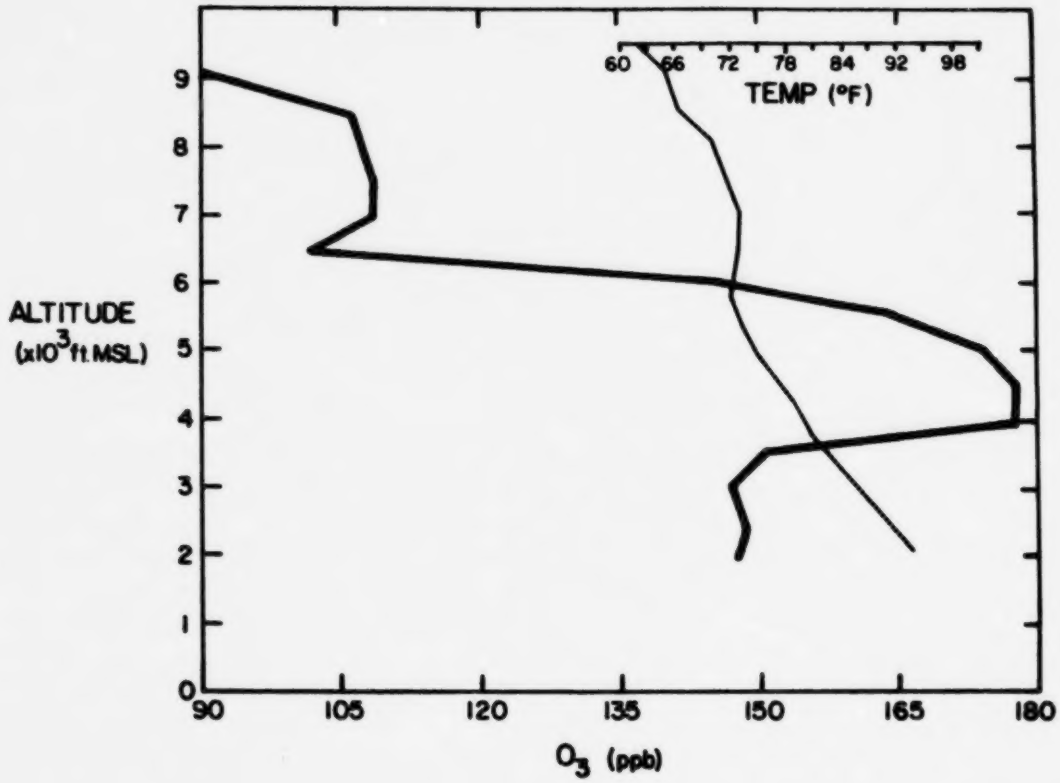

Figure B22. Vertical ozone and temperature profiles at 1430 on July 20, 1977.

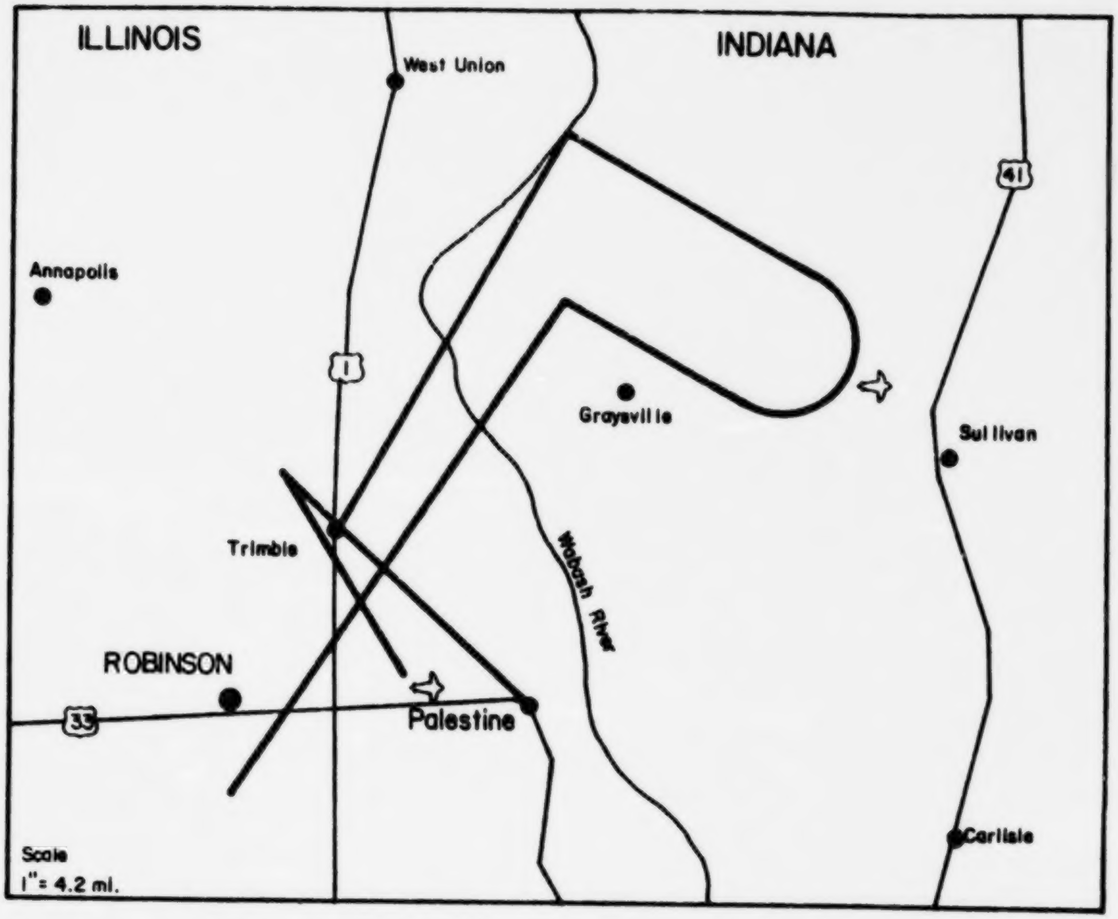
ILLINOIS
INDIANA
West Union
41
Annapolis
1
Graysville
Sullivan
Trimble
Wabash River
ROBINSON
33
Palestine
Carlisle
Scale
1"= 4.2 mi.

Figure B23. Flight path on July 21, 1977 (0630-0745 CDT)

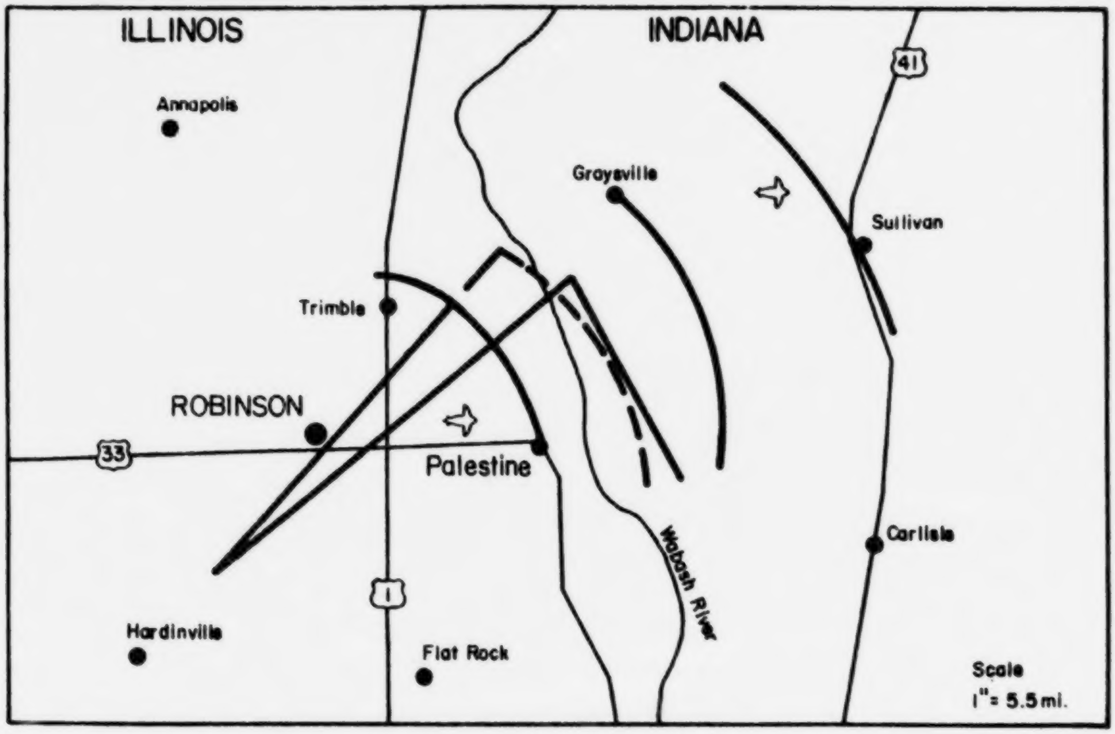
ILLINOIS
INDIANA
41
Annapolis
Graysville
Sullivan
Trimble
ROBINSON
33
Palestine
Wabash River
Carlisle
1
Hardinville
Flat Rock
Scale
1"= 5.5mi.

Figure B24. Flight path on July 21, 1977 (1005-1200 CDT)

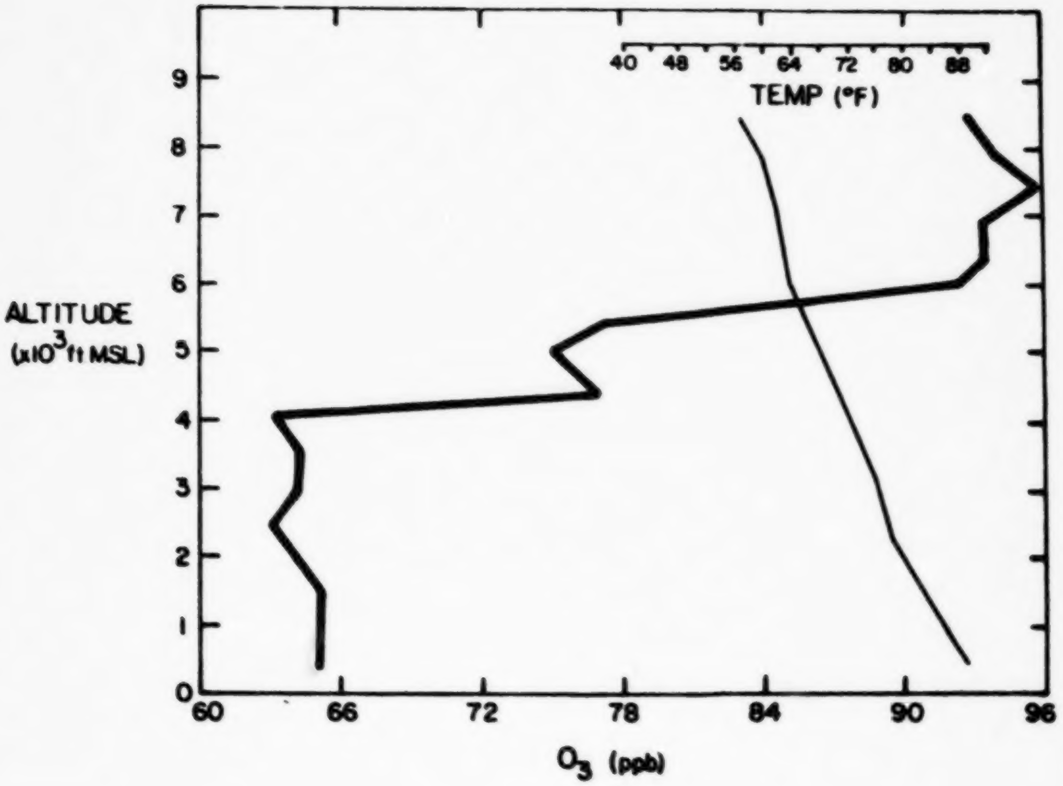

Figure B25. Vertical ozone and temperature profiles at 1019 on July 21, 1977.

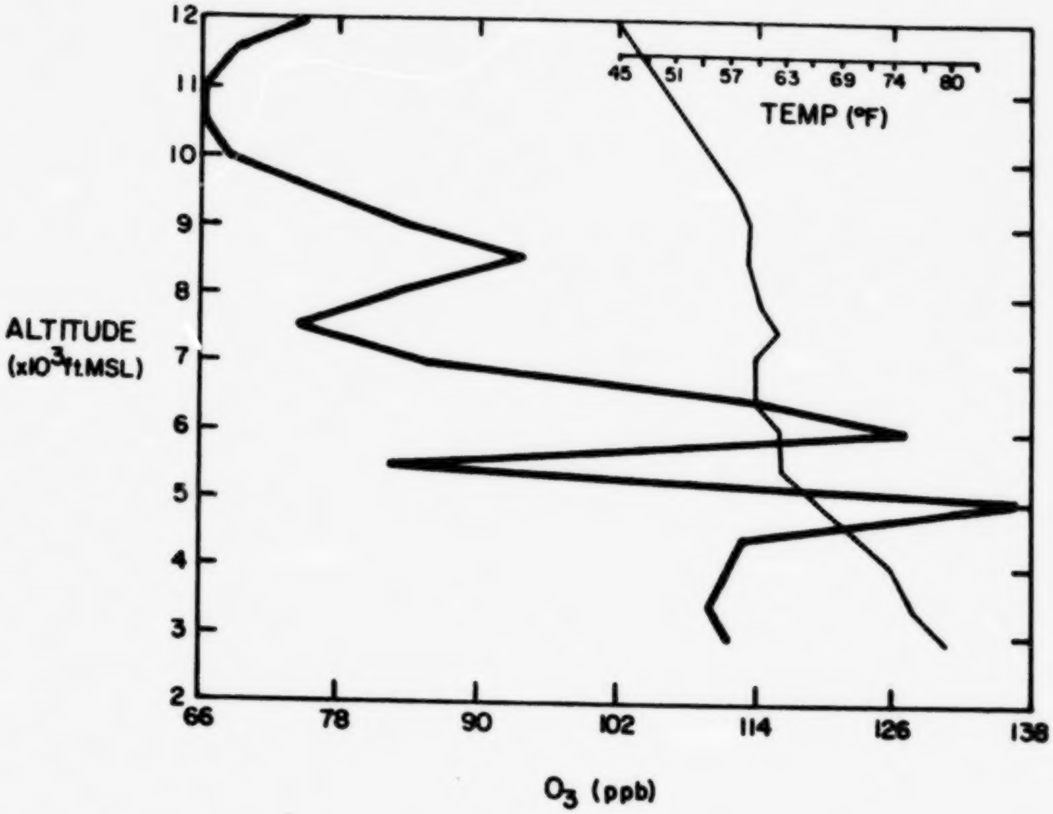

Figure B26. Vertical ozone and temperature profiles at 1520 on July 24, 1977.

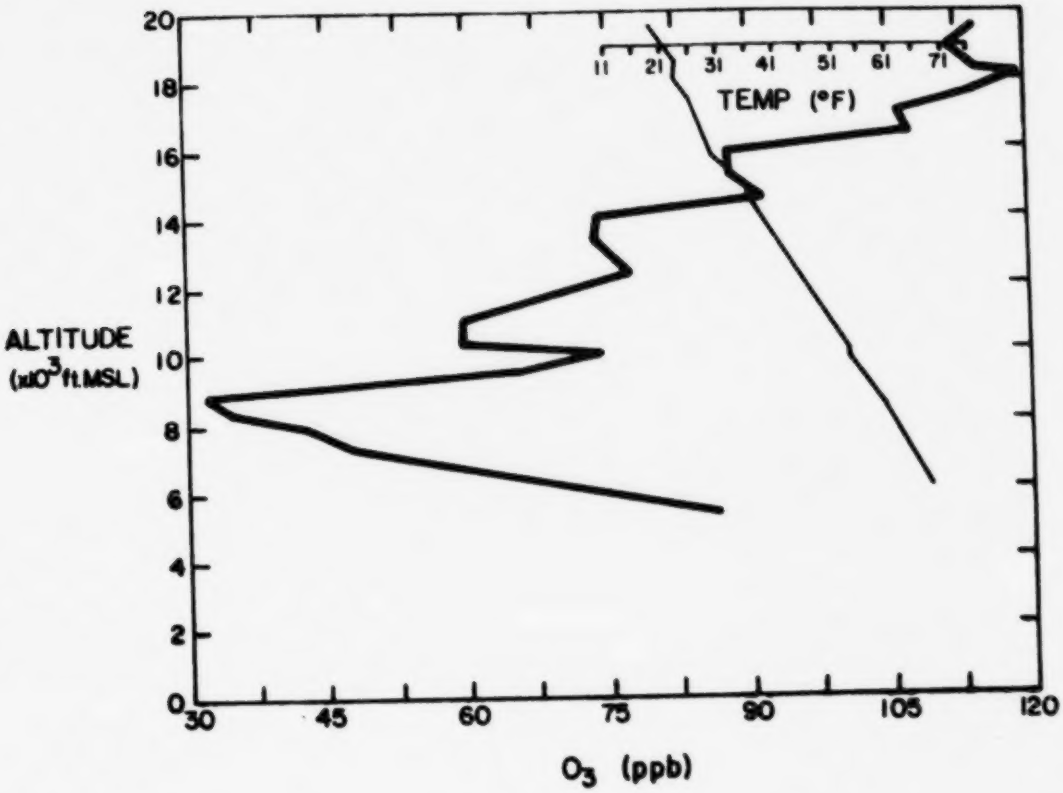

Figure B27. Vertical ozone and temperature profiles at 1830 on July 24, 1977.

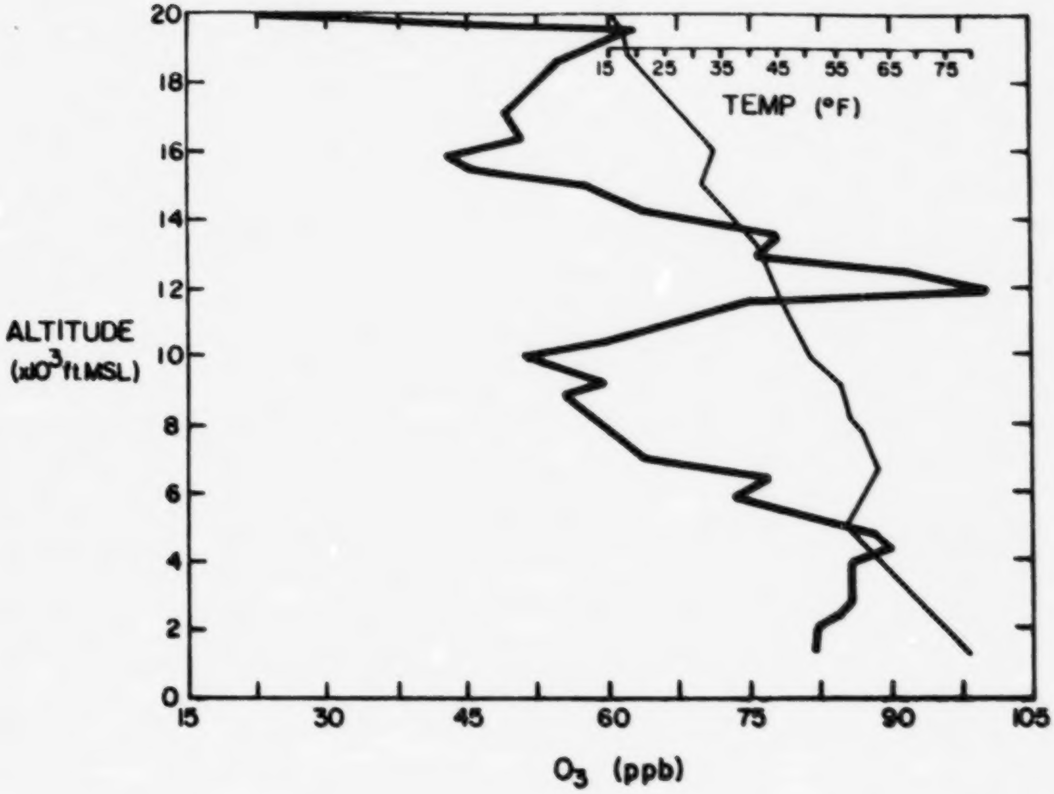

Figure B28. Vertical ozone and temperature profiles at 1343 on July 27, 1977.

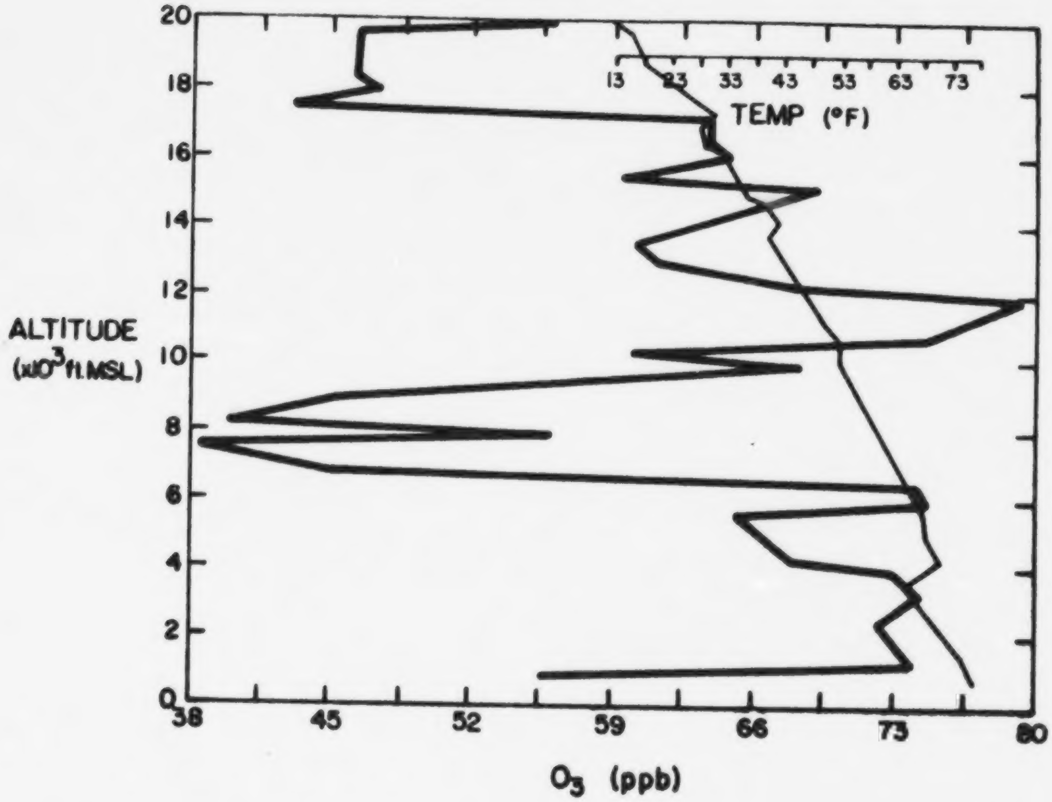

Figure B29. Vertical ozone and temperature profiles at 0620 on July 28, 1977.

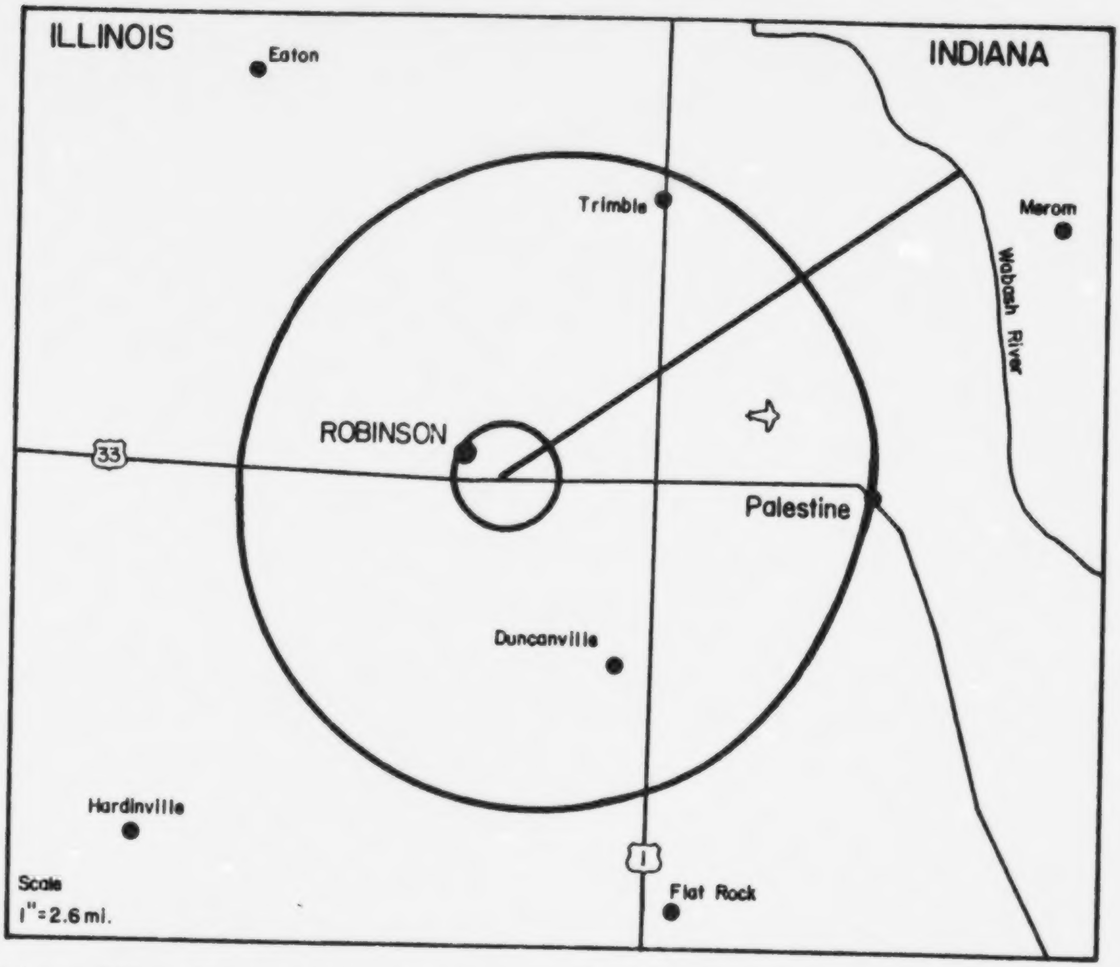
ILLINOIS
Eaton
INDIANA
Trimble
Merom
Wabash River
ROBINSON
33
Palestine
Duncanville
Hardinville
1
Scale
1"=2.6 mi.
Flat Rock

Figure B30. Flight path on July 28, 1977 (1418-1550 CDT)

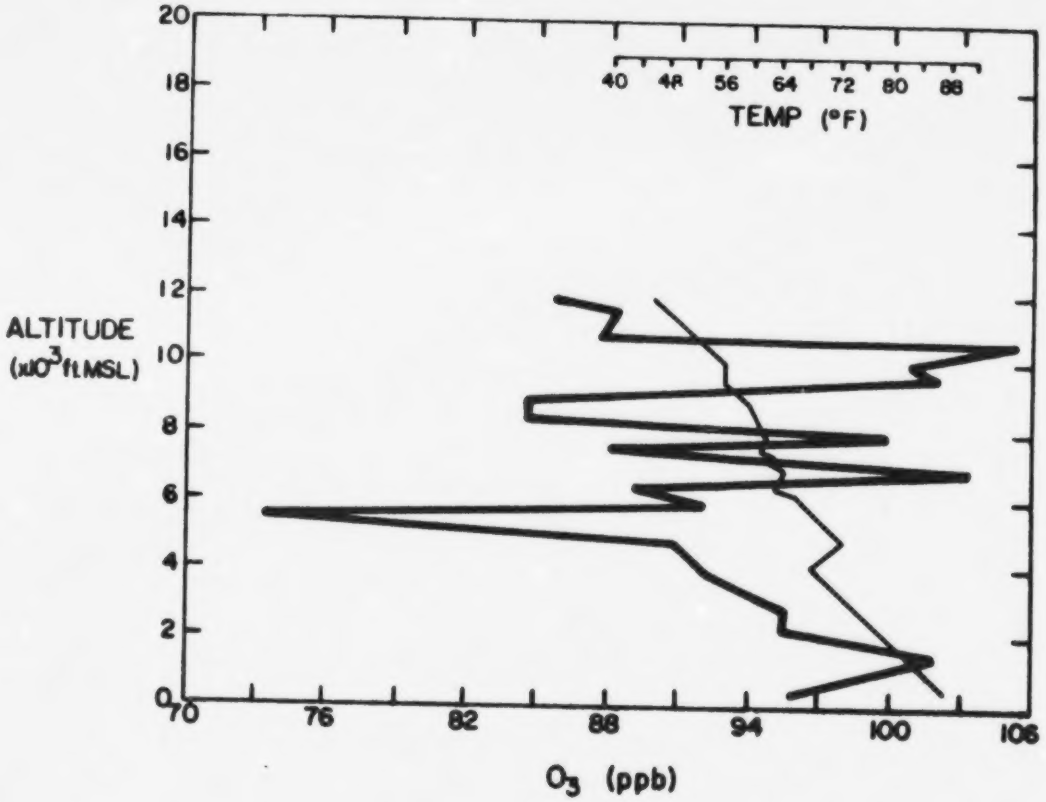

Figure B31. Vertical ozone and temperature profiles at 1902 on July 28, 1977.

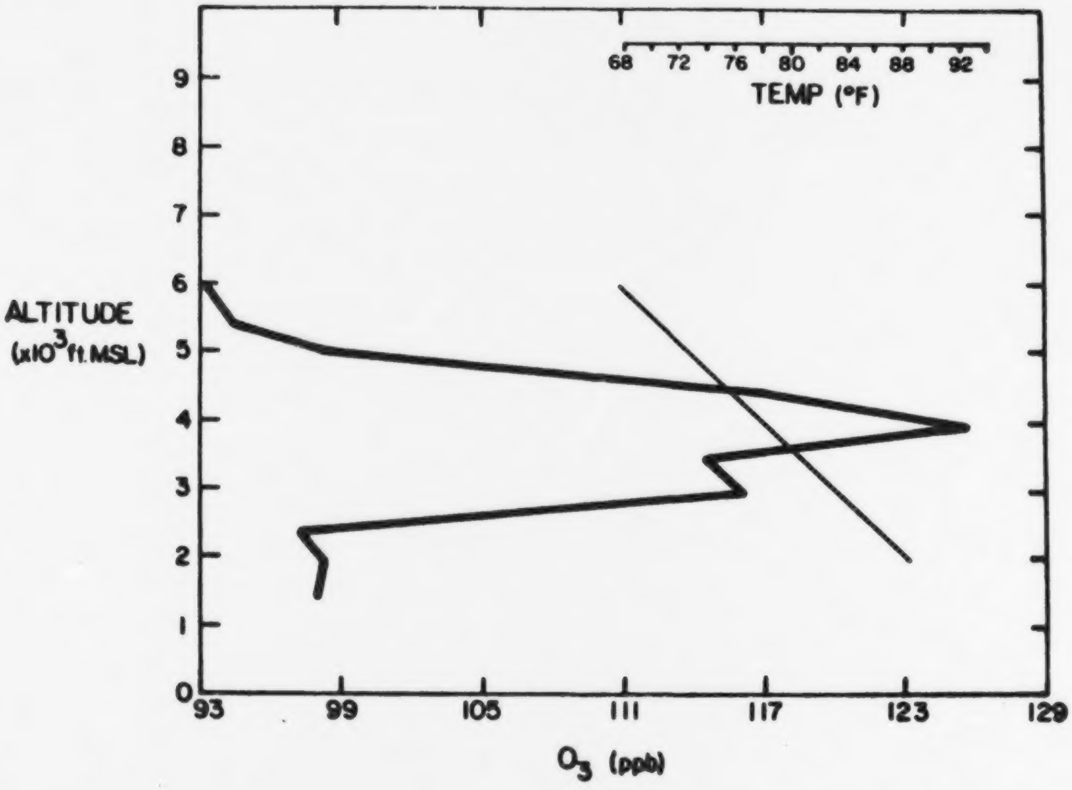

Figure B32. Vertical ozone and temperature profiles at 1042 on July 30, 1977.

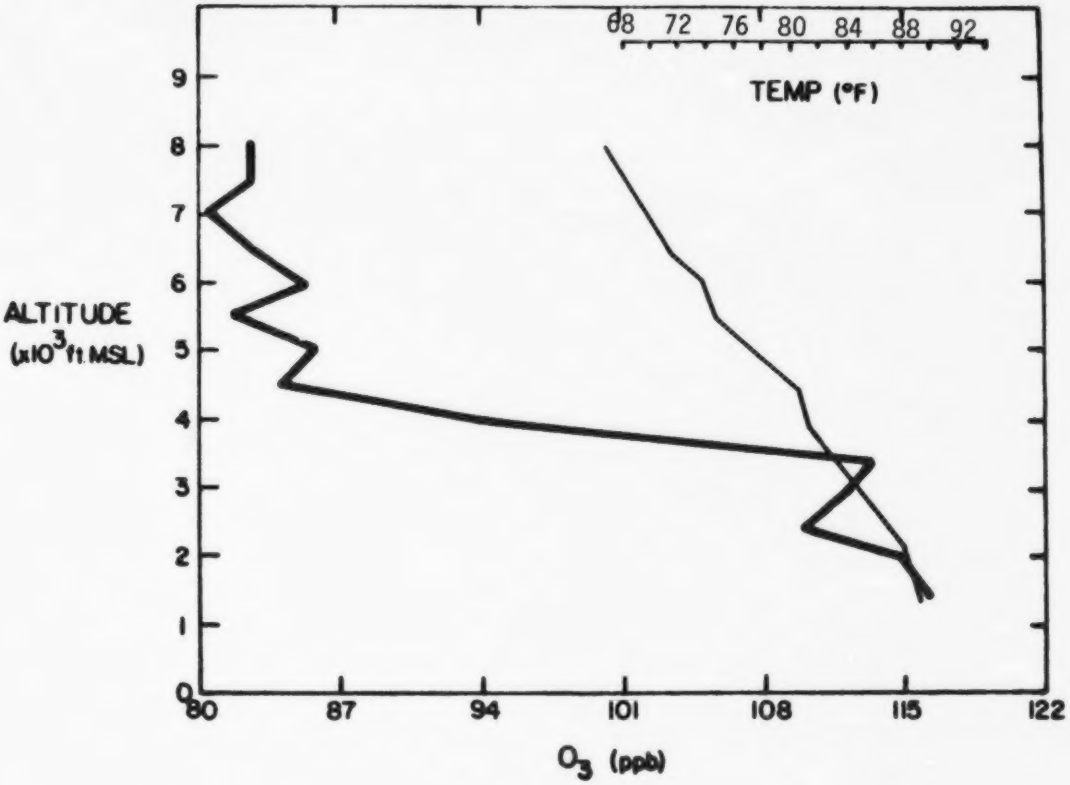

Figure B33. Vertical ozone and temperature profiles at 1114 on July 30, 1977.

APPENDIX C

Appendix C summarizes all individual C_2-C_{10} nonmethane hydrocarbon concentrations measured in samples collected at ground level and onboard the instrumented aircraft.

TABLE C1. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 0.5 MILE DOWNWIND OF REFINERY ON 6-23-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
9.5	Ethane	5.0	2,3-Dimethylpentane
4.0	Ethylene	3.0	3-Methylhexane
1.0	Acetylene	3.0	2,2,3-Trimethylpentane
36.0	Propane	3.0	n-Heptane
4.5	Propene	3.5	Methylcyclohexane
12.5	i-Butane	1.0	2,4-Dimethylhexane
27.0	n-Butane	0.5	2,3,4-Trimethylpentane
1.0	1-Butene	8.0	Toluene
---	i-Butene	0.5	2,3-Dimethylhexane
1.0	t-2-Butene	1.5	2-Methylheptane
1.5	c-2-Butene	1.5	3-Ethylhexane
26.5	i-Pentane	1.0	n-Octane
9.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	1.5	Ethylbenzene
---	t-2-Pentene	3.0	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	1.0	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
7.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
5.0	3-Methylpentane	1.0	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
6.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
4.5	Methylcyclopentane	---	Methylstyrene
1.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
3.5	Benzene	---	1,4-Diethylbenzene
2.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	12.0	6
Σ Aromatic	22.0	11
Σ Paraffin	174.0	83
Acetylene	1.0	-
	209	

TABLE C2. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 0.5 MILE UPWIND OF REFINERY ON 6-23-77

ug/m³	Hydrocarbon	ug/m³	Hydrocarbon
5.0	Ethane	2.5	2,3-Dimethylpentane
1.5	Ethylene	1.5	3-Methylhexane
1.5	Acetylene	1.0	2,2,3-Trimethylpentane
13.5	Propane	1.5	n-Heptane
2.0	Propene	1.0	Methylcyclohexane
17.0	i-Butane	---	2,4-Dimethylhexane
70.0	n-Butane	---	2,3,4-Trimethylpentane
1.5	1-Butene	4.5	Toluene
---	i-Butene	---	2,3-Dimethylhexane
1.0	t-2-Butene	1.0	2-Methylheptane
1.5	c-2-Butene	1.0	3-Ethylhexane
46.5	i-Pentane	---	n-Octane
18.0	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	1.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	0.5	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
8.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
5.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
4.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
4.0	Methylcyclopentane	---	Methylstyrene
1.0	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
3.5	Benzene	---	1,4-Diethylbenzene
1.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m³	%
Σ Olefin	8.5	4
Σ Aromatic	14.5	6
Σ Paraffin	204.0	89
Acetylene	1.5	1
	229	

TABLE C3. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 0.5 MILE DOWNWIND OF REFINERY ON 6-23-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
93.0	Ethane	5.0	2,3-Dimethylpentane
8.0	Ethylene	3.0	3-Methylhexane
1.0	Acetylene	3.0	2,2,3-Trimethylpentane
102	Propane	3.5	n-Heptane
9.0	Propene	3.5	Methylcyclohexane
26.0	i-Butane	0.5	2,4-Dimethylhexane
61.0	n-Butane	0.5	2,3,4-Trimethylpentane
2.0	1-Butene	31.0	Toluene
2.0	i-Butene	1.0	2,3-Dimethylhexane
---	t-2-Butene	2.0	2-Methylheptane
---	c-2-Butene	2.0	3-Ethylhexane
39.0	i-Pentane	1.0	n-Octane
16.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	1.5	Ethylbenzene
---	t-2-Pentene	4.0	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	1.0	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
9.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
6.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
6.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
6.0	Methylcyclopentane	---	Methylstyrene
1.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
4.5	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	21.0	5
Σ Aromatic	48.0	10
Σ Paraffin	390	85
Acetylene	1.0	-
	460	

TABLE C4. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 0.5 MILE EAST OF REFINERY ON 6-24-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.0	Ethane	13.0	2,3-Dimethylpentane
1.0	Ethylene	7.0	3-Methylhexane
---	Acetylene	4.0	2,2,3-Trimethylpentane
46.0	Propane	7.0	n-Heptane
2.0	Propene	7.5	Methylcyclohexane
5.0	i-Butane	2.5	2,4-Dimethylhexane
27.0	n-Butane	2.0	2,3,4-Trimethylpentane
---	1-Butene	23.0	Toluene
---	i-Butene	2.0	2,3-Dimethylhexane
---	t-2-Butene	4.5	2-Methylheptane
---	c-2-Butene	4.0	3-Ethylhexane
34.0	i-Pentane	3.0	n-Octane
16.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	5.5	Ethylbenzene
---	t-2-Pentene	18.0	p & m-Xylene
---	c-2-Pentene	2.0	Styrene
---	Cyclopentene	6.5	o-Xylene
---	Cyclopentane	2.0	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
17.0	2-Methylpentane	1.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	3.5	p-Ethyltoluene
10.5	3-Methylpentane	2.5	m-Ethyltoluene
---	1-Hexene	3.0	o-Ethyltoluene
10.5	n-Hexane	2.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	6.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
11.5	Methylcyclopentane	---	Methylstyrene
3.5	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
6.5	Benzene	1.0	1,4-Diethylbenzene
4.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.0	1
Σ Aromatic	82.5	24
Σ Paraffin	250.0	75
Acetylene	---	-
	336	

TABLE C5. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 0.5 MILE EAST OF REFINERY 6-25-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.0	Ethane	4.0	2,3-Dimethylpentane
2.0	Ethylene	3.0	3-Methylhexane
---	Acetylene	6.5	2,2,3-Trimethylpentane
36.0	Propane	3.5	n-Heptane
2.0	Propene	4.5	Methylcyclohexane
17.0	i-Butane	1.0	2,4-Dimethylhexane
79.5	n-Butane	1.0	2,3,4-Trimethylpentane
---	1-Butene	5.0	Toluene
1.5	i-Butene	1.0	2,3-Dimethylhexane
1.5	t-2-Butene	1.5	2-Methylheptane
2.0	c-2-Butene	1.5	3-Ethylhexane
74.0	i-Pentane	1.0	n-Octane
23.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
11.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
6.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
6.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
7.0	Methylcyclopentane	---	Methylstyrene
4.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
4.0	Benzene	---	1,4-Diethylbenzene
2.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	9.5	3
Σ Aromatic	14.5	4
Σ Paraffin	308.0	93
Acetylene	---	-
	332	

TABLE C6. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED NEAR THE LINCOLN T-RAIL COLLEGE ENTRANCE 2 MILES DOWNWIND ON 6-25-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
10.0	Ethane	2.0	2,3-Dimethylpentane
2.0	Ethylene	1.0	3-Methylhexane
---	Acetylene	1.0	2,2,3-Trimethylpentane
18.0	Propane	2.5	n-Heptane
5.0	Propene	2.5	Methylcyclohexane
4.0	i-Butane	---	2,4-Dimethylhexane
11.0	n-Butane	---	2,3,4-Trimethylpentane
1.5	1-Butene	2.5	Toluene
1.5	i-Butene	---	2,3-Dimethylhexane
1.0	t-2-Butene	1.5	2-Methylheptane
---	c-2-Butene	1.0	3-Ethylhexane
6.0	i-Pentane	1.5	n-Octane
5.0	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	1.0	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
3.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
2.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.5	Benzene	---	1,4-Diethylbenzene
1.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	12.0	12
Σ Aromatic	9.0	9
Σ Paraffin	78.0	79
Acetylene	---	-
	99	

TABLE C7. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT THE WSU TRAILER OUT OF PLUME ON 6-25-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.5	Ethane		
1.0	Ethylene	1.0	2,3-Dimethylpentane
0.5	Acetylene	0.5	3-Methylhexane
15.0	Propane	0.5	2,2,3-Trimethylpentane
2.5	Propene	1.0	n-Heptane
4.0	i-Butane	1.0	Methylcyclohexane
14.0	n-Butane	---	2,4-Dimethylhexane
0.5	1-Butene	---	2,3,4-Trimethylpentane
0.5	i-Butene	1.5	Toluene
0.5	t-2-Butene	---	2,3-Dimethylhexane
---	c-2-Butene	0.5	2-Methylheptane
9.0	i-Pentane	0.5	3-Ethylhexane
4.0	n-Pentane	0.5	n-Octane
---	1-Pentene	---	Ethylcyclohexane
---	t-2-Pentene	0.5	Ethylbenzene
---	c-2-Pentene	1.0	p & m-Xylene
---	Cyclopentene	0.5	Styrene
---	Cyclopentane	0.5	o-Xylene
---	2,3-Dimethylbutane	---	n-Nonane
2.0	2-Methylpentane	---	i-Propylbenzene
---	c-4-Methyl-2-pentene	---	n-Propylbenzene
1.0	3-Methylpentane	---	p-Ethyltoluene
---	1-Hexene	---	m-Ethyltoluene
1.5	n-Hexane	---	o-Ethyltoluene
---	t-2-Hexene	---	1,3,5-Trimethylbenzene
---	c-2-Hexene	0.5	1,2,4-Trimethylbenzene
1.0	Methylcyclopentane	---	1,2,3-Trimethylbenzene
0.5	2,4-Dimethylpentane	---	Methylstyrene
1.0	Benzene	---	1,3-Diethylbenzene
0.5	Cyclohexane	---	1,4-Diethylbenzene

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.0	6
Σ Aromatic	5.5	7
Σ Paraffin	65.5	87
Acetylene	0.5	1
	76.5	

TABLE C8. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT THE WSU TRAILER OUT OF PLUME ON 6-25-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
4.0	Ethane	0.5	2,3-Dimethylpentane
1.0	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	0.5	2,2,3-Trimethylpentane
11.5	Propane	0.5	n-Heptane
2.0	Propene	0.5	Methylcyclohexane
1.5	i-Butane	---	2,4-Dimethylhexane
5.5	n-Butane	---	2,3,4-Trimethylpentane
---	1-Butene	1.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
3.0	i-Pentane	0.5	n-Octane
2.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	---	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.5	8
Σ Aromatic	3.0	7
Σ Paraffin	36.0	84
Acetylene	0.5	1
	43	

TABLE C9. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 6-26-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
56.5	Ethane		
17.0	Ethylene	5.5	2,3-Dimethylpentane
1.0	Acetylene	2.0	3-Methylhexane
53.0	Propane	5.0	2,2,3-Trimethylpentane
14.0	Propene	3.0	n-Heptane
25.5	i-Butane	3.0	Methylcyclohexane
47.5	n-Butane	0.5	2,4-Dimethylhexane
0.5	1-Butene	1.0	2,3,4-Trimethylpentane
2.0	i-Butene	7.0	Toluene
2.0	t-2-Butene	1.0	2,3-Dimethylhexane
2.0	c-2-Butene	1.5	2-Methylheptane
30.0	i-Pentane	1.5	3-Ethylhexane
10.5	n-Pentane	1.5	n-Octane
1.0	1-Pentene	---	Ethylcyclohexane
---	t-2-Pentene	1.5	Ethylbenzene
---	c-2-Pentene	4.5	p & m-Xylene
---	Cyclopentene	1.0	Styrene
---	Cyclopentane	2.0	o-Xylene
---	2,3-Dimethylbutane	1.0	n-Nonane
5.0	2-Methylpentane	0.5	i-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	n-Propylbenzene
3.0	3-Methylpentane	0.5	p-Ethyltoluene
---	1-Hexene	0.5	m-Ethyltoluene
4.0	n-Hexane	0.5	o-Ethyltoluene
---	t-2-Hexene	0.5	1,3,5-Trimethylbenzene
---	c-2-Hexene	1.0	1,2,4-Trimethylbenzene
3.5	Methylcyclopentane	---	1,2,3-Trimethylbenzene
2.0	2,4-Dimethylpentane	---	Methylstyrene
3.0	Benzene	---	1,3-Diethylbenzene
2.0	Cyclohexane	---	1,4-Diethylbenzene

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	33.5	10
Σ Aromatic	23.0	7
Σ Paraffin	269	83
Acetylene	1.0	-
	327	

TABLE C10. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 6-26-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
69.5	Ethane	4.0	2,3-Dimethylpentane
6.5	Ethylene	1.4	3-Methylhexane
---	Acetylene	4.5	2,2,3-Trimethylpentane
64.5	Propane	2.0	n-Heptane
2.0	Propene	1.5	Methylcyclohexane
25.5	i-Butane	0.5	2,4-Dimethylhexane
56.0	n-Butane	1.0	2,3,4-Trimethylpentane
0.5	1-Butene	4.5	Toluene
0.5	i-Butene	1.0	2,3-Dimethylhexane
---	t-2-Butene	1.0	2-Methylheptane
0.5	c-2-Butene	1.0	3-Ethylhexane
35.5	i-Pentane	1.0	n-Octane
12.0	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	1.0	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
5.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
3.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
5.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
2.5	Methylcyclopentane	---	Methylstyrene
2.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
3.0	Benzene	---	1,4-Diethylbenzene
2.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	6.0	2
Σ Aromatic	13.0	4
Σ Paraffin	304	94
Acetylene	---	
	323	

TABLE C11. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT THE WSU TRAILER OUT OF PLUME ON 6-27-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
6.0	Ethane	1.0	2,3-Dimethylpentane
1.5	Ethylene	0.5	3-Methylhexane
---	Acetylene	0.5	2,2,3-Trimethylpentane
14.0	Propane	0.5	n-Heptane
2.0	Propene	0.5	Methylcyclohexane
2.5	i-Butane	---	2,4-Dimethylhexane
9.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.0	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
4.5	i-Pentane	0.5	n-Octane
3.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
2.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	4.0	6
Σ Aromatic	6.5	11
Σ Paraffin	50.5	83
Acetylene	---	
	60	

TABLE C12. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED IN AN OAK GROVE ON 6-28-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
9.5	Ethane	0.5	2,3-Dimethylpentane
1.0	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	0.5	2,2,3-Trimethylpentane
16.0	Propane	0.5	n-Heptane
2.0	Propene	0.5	Methylcyclohexane
2.5	i-Butane	0.5	2,4-Dimethylhexane
6.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.0	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
3.0	i-Pentane	---	n-Octane
2.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
0.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
0.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.5	6
Σ Aromatic	6.0	11
Σ Paraffin	45.5	82
Acetylene	0.5	1
	55.5	

TABLE C13. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT THE WSU TRAILER OUT OF THE PLUME ON 6-28.77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
12.5	Ethane	1.0	2,3-Dimethylpentane
2.5	Ethylene	0.5	3-Methylhexane
1.5	Acetylene	0.5	2,2,3-Trimethylpentane
27.0	Propane	1.0	n-Heptane
3.0	Propene	0.5	Methylcyclohexane
4.0	i-Butane	---	2,4-Dimethylhexane
14.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	2.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
0.5	t-2-Butene	0.5	2-Methylheptane
0.5	c-2-Butene	0.5	3-Ethylhexane
6.0	i-Pentane	0.5	n-Octane
5.0	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	0.5	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
2.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
2.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
2.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.5	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	8.0	8
Σ Aromatic	7.0	7
Σ Paraffin	82.0	84
Acetylene	1.5	1
	98	

TABLE C14. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 6-28-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
18.0	Ethane	11.0	2,3-Dimethylpentane
3.5	Ethylene	6.5	3-Methylhexane
0.5	Acetylene	1.5	2,2,3-Trimethylpentane
58.0	Propane	8.0	n-Heptane
3.0	Propene	9.5	Methylcyclohexane
47.0	i-Butane	1.0	2,4-Dimethylhexane
135	n-Butane	1.0	2,3,4-Trimethylpentane
0.5	1-Butene	68	Toluene
2.0	i-Butene	3.0	2,3-Dimethylhexane
2.0	t-2-Butene	7.0	2-Methylheptane
2.0	c-2-Butene	7.5	3-Ethylhexane
136	i-Pentane	7.0	n-Octane
58.0	n-Pentane	---	Ethylcyclohexane
1.5	1-Pentene	2.5	Ethylbenzene
---	t-2-Pentene	7.5	p & m-Xylene
---	c-2-Pentene	2.5	Styrene
---	Cyclopentene	3.0	o-Xylene
---	Cyclopentane	3.0	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
29.0	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.5	p-Ethyltoluene
16.5	3-Methylpentane	1.0	m-Ethyltoluene
---	1-Hexene	1.5	o-Ethyltoluene
17.5	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	2.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
17.0	Methylcyclopentane	---	Methylstyrene
3.0	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
8.0	Benzene	0.5	1,4-Diethylbenzene
6.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	14.5	2
Σ Aromatic	248	28
Σ Paraffin	611	70
Acetylene	0.5	-
	874	

TABLE C15. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED IN LINCOLN TRAIL COLLEGE PARKING LOT 1.5 MILES DOWNWIND ON 6-28-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
11.0	Ethane	7.0	2,3-Dimethylpentane
2.5	Ethylene	3.5	3-Methylhexane
---	Acetylene	4.0	2,2,3-Trimethylpentane
38.0	Propane	3.0	n-Heptane
2.0	Propene	2.5	Methylcyclohexane
35.5	i-Butane	0.5	2,4-Dimethylhexane
243	n-Butane	1.0	2,3,4-Trimethylpentane
0.5	1-Butene	10.0	Toluene
3.0	i-Butene	1.0	2,3-Dimethylhexane
4.5	t-2-Butene	1.0	2-Methylheptane
4.5	c-2-Butene	1.0	3-Ethylhexane
104	i-Pentane	1.0	n-Octane
36.0	n-Pentane	---	Ethylcyclohexane
4.5	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	3.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	0.5	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
18.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
11.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
9.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
8.5	Methylcyclopentane	---	Methylstyrene
3.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
5.5	Benzene	---	1,4-Diethylbenzene
2.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	21.5	4
Σ Aromatic	23.5	4
Σ Paraffin	551	92
Acetylene	---	-
	596	

TABLE C16. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 1 MILE NE OF LINCOLN TRAIL PARKING LOT ~2.5 MILES DOWNWIND ON 6-28-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
10.0	Ethane	1.0	2,3-Dimethylpentane
1.0	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	0.5	2,2,3-Trimethylpentane
18.0	Propane	0.5	n-Heptane
2.0	Propene	0.5	Methylcyclohexane
4.0	i-Butane	---	2,4-Dimethylhexane
15.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	2.0	Toluene
---	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	1.0	3-Ethylhexane
7.5	i-Pentane	0.5	n-Octane
4.0	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
1.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	4.0	5
Σ Aromatic	9.5	11
Σ Paraffin	71.0	83
Acetylene	0.5	1
	85	

TABLE C17. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 6-29-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
2.0	Ethane	1.0	2,3-Dimethylpentane
1.5	Ethylene	0.5	3-Methylhexane
1.5	Acetylene	0.5	2,2,3-Trimethylpentane
11.5	Propane	1.0	n-Heptane
2.0	Propene	1.0	Methylcyclohexane
1.5	i-Butane	---	2,4-Dimethylhexane
6.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
4.0	i-Pentane	---	n-Octane
2.0	n-Pentane	---	Ethylcyclohexane
1.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	1.0	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
3.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	4.5	9
Σ Aromatic	3.5	7
Σ Paraffin	40.5	81
Acetylene	1.5	3
	10	

TABLE C18. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT REFINERY FENCELINE NEAR STORAGE TANKS ON 6-29-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
60.0	**Ethane**	4.0	**2,3-Dimethylpentane**
6.0	**Ethylene**	2.0	**3-Methylhexane**
1.5	**Acetylene**	1.0	**2,2,3-Trimethylpentane**
62.0	**Propane**	3.5	**n-Heptane**
11.5	**Propene**	3.5	**Methylcyclohexane**
14.5	**i-Butane**	0.5	**2,4-Dimethylhexane**
29.0	**n-Butane**	0.5	**2,3,4-Trimethylpentane**
0.5	**1-Butene**	8.0	**Toluene**
3.5	**i-Butene**	1.0	**2,3-Dimethylhexane**
4.0	**t-2-Butene**	2.0	**2-Methylheptane**
3.0	**c-2-Butene**	2.0	**3-Ethylhexane**
17.5	**i-Pentane**	2.0	**n-Octane**
11.0	**n-Pentane**	---	**Ethylcyclohexane**
1.0	**1-Pentene**	1.5	**Ethylbenzene**
---	**t-2-Pentene**	3.0	**p & m-Xylene**
---	**c-2-Pentene**	1.5	**Styrene**
---	**Cyclopentene**	1.0	**o-Xylene**
---	**Cyclopentane**	2.0	**n-Nonane**
---	**2,3-Dimethylbutane**	0.5	**i-Propylbenzene**
5.5	**2-Methylpentane**	---	**n-Propylbenzene**
---	**c-4-Methyl-2-pentene**	1.0	**p-Ethyltoluene**
3.5	**3-Methylpentane**	0.5	**m-Ethyltoluene**
---	**1-Hexene**	1.0	**o-Ethyltoluene**
6.0	**n-Hexane**	1.0	**1,3,5-Trimethylbenzene**
---	**t-2-Hexene**	1.5	**1,2,4-Trimethylbenzene**
---	**c-2-Hexene**	---	**1,2,3-Trimethylbenzene**
5.0	**Methylcyclopentane**	---	**Methylstyrene**
1.0	**2,4-Dimethylpentane**	---	**1,3-Diethylbenzene**
3.0	**Benzene**	0.5	**1,4-Diethylbenzene**
2.0	**Cyclohexane**		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	29.5	10
Σ Aromatic	26.0	9
Σ Paraffin	239	81
Acetylene	1.5	-
	296	

TABLE C19. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED NEAR FENCELINE AT SOUTH END OF REFINERY 6-29-77

ug/m³	Hydrocarbon	ug/m³	Hydrocarbon
35.0	Ethane	4.0	2,3-Dimethylpentane
4.0	Ethylene	2.5	3-Methylhexane
1.0	Acetylene	1.0	2,2,3-Trimethylpentane
51.0	Propane	3.5	n-Heptane
5.0	Propene	3.5	Methylcyclohexane
15.0	i-Butane	0.5	2,4-Dimethylhexane
42.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	5.0	Toluene
1.5	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	1.5	2-Methylheptane
1.0	c-2-Butene	1.0	3-Ethylhexane
26.0	i-Pentane	1.5	n-Octane
13.5	n-Pentane	---	Ethylcyclohexane
1.5	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	1.0	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
6.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
4.5	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
7.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
5.0	Methylcyclopentane	---	Methylstyrene
1.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
2.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m³	%
Σ Olefin	13.5	5
Σ Aromatic	16.0	6
Σ Paraffin	229.	89
Acetylene	1.0	-
	259.5	

TABLE C20. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 6-30-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
6.0	Ethane	1.0	2,3-Dimethylpentane
3.0	Ethylene	0.5	3-Methylhexane
1.0	Acetylene	0.5	2,2,3-Trimethylpentane
17.0	Propane	0.5	n-Heptane
2.0	Propene	0.5	Methylcyclohexane
3.0	i-Butane	---	2,4-Dimethylhexane
10.0	n-Butane	---	2,3,4-Trimethylpentane
1.0	1-Butene	1.5	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
0.5	c-2-Butene	---	3-Ethylhexane
5.5	i-Pentane	0.5	n-Octane
4.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.5	8
Σ Aromatic	4.5	7
Σ Paraffin	55.5	84
Acetylene	1.0	1
	66.5	

TABLE C21. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED NORTH OF REFINERY AT FENCELINE ON 6-30-77

ug/m3	Hydrocarbon	ug/m3	Hydrocarbon
94.0	Ethane	28.5	2,3-Dimethylpentane
20.0	Ethylene	12.0	3-Methylhexane
2.0	Acetylene	15.0	2,2,3-Trimethylpentane
131	Propane	15.5	n-Heptane
47.0	Propene	12.5	Methylcyclohexane
51.0	i-Butane	3.5	2,4-Dimethylhexane
116	n-Butane	5.5	2,3,4-Trimethylpentane
0.5	1-Butene	52.5	Toluene
15.0	i-Butene	5.0	2,3-Dimethylhexane
14.5	t-2-Butene	13.5	2-Methylheptane
13.5	c-2-Butene	9.5	3-Ethylhexane
105	i-Pentane	13.5	n-Octane
55.0	n-Pentane	---	Ethylcyclohexane
2.0	1-Pentene	10.5	Ethylbenzene
---	t-2-Pentene	15.5	p & m-Xylene
---	c-2-Pentene	4.0	Styrene
---	Cyclopentene	4.0	o-Xylene
---	Cyclopentane	9.0	n-Nonane
---	2,3-Dimethylbutane	2.0	i-Propylbenzene
25.0	2-Methylpentane	1.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	2.0	p-Ethyltoluene
16.0	3-Methylpentane	1.0	m-Ethyltoluene
---	1-Hexene	2.0	o-Ethyltoluene
30.5	n-Hexane	1.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	3.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
23.0	Methylcyclopentane	---	Methylstyrene
9.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
11.0	Benzene	1.0	1,4-Diethylbenzene
10.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m3	%
Σ Olefin	113	11
Σ Aromatic	112	11
Σ Paraffin	828	78
Acetylene	2.0	-
	1055	

TABLE C22. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED NORTH OF REFINERY AT FENCELINE ON 6-30-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
52.0	Ethane	14.0	2,3-Dimethylpentane
20.0	Ethylene	7.5	3-Methylhexane
10.5	Acetylene	5.0	2,2,3-Trimethylpentane
82.0	Propane	13.0	n-Heptane
22.0	Propene	13.0	Methylcyclohexane
31.5	i-Butane	1.0	2,4-Dimethylhexane
59.5	n-Butane	2.0	2,3,4-Trimethylpentane
0.5	1-Butene	15.0	Toluene
6.0	i-Butene	2.0	2,3-Dimethylhexane
6.0	t-2-Butene	6.0	2-Methylheptane
5.5	c-2-Butene	5.0	3-Ethylhexane
44.0	i-Pentane	6.0	n-Octane
29.5	n-Pentane	---	Ethylcyclohexane
3.0	1-Pentene	4.0	Ethylbenzene
---	t-2-Pentene	9.0	p & m-Xylene
---	c-2-Pentene	1.5	Styrene
---	Cyclopentene	3.0	o-Xylene
---	Cyclopentane	4.0	n-Nonane
---	2,3-Dimethylbutane	1.0	i-Propylbenzene
16.0	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
10.5	3-Methylpentane	1.5	m-Ethyltoluene
---	1-Hexene	1.5	o-Ethyltoluene
17.5	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	2.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
13.5	Methylcyclopentane	---	Methylstyrene
3.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
8.0	Benzene	0.5	1,4-Diethylbenzene
7.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	63.0	11
Σ Aromatic	51.0	9
Σ Paraffin	445	78
Acetylene	10.5	2
	569	

TABLE C23. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER ON 6-30-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
17.0	Ethane	1.0	2,3-Dimethylpentane
12.0	Ethylene	1.0	3-Methylhexane
2.0	Acetylene	1.0	2,2,3-Trimethylpentane
30.0	Propane	0.5	n-Heptane
11.0	Propene	0.5	Methylcyclohexane
8.0	i-Butane	0.5	2,4-Dimethylhexane
21.0	n-Butane	---	2,3,4-Trimethylpentane
1.0	1-Butene	2.0	Toluene
2.5	i-Butene	1.0	2,3-Dimethylhexane
4.0	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	1.5	3-Ethylhexane
13.5	i-Pentane	1.0	n-Octane
8.0	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	1.5	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	1.5	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	4.0	o-Ethyltoluene
2.0	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	3.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
1.5	Benzene	0.5	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	29.0	18
Σ Aromatic	17.0	10
Σ Paraffin	114	70
Acetylene	2.0	1
	162	

TABLE C24. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-1-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
5.0	Ethane	1.0	2,3-Dimethylpentane
2.0	Ethylene	1.0	3-Methylhexane
1.5	Acetylene	0.5	2,2,3-Trimethylpentane
15.0	Propane	1.0	n-Heptane
2.0	Propene	1.0	Methylcyclohexane
2.0	i-Butane	---	2,4-Dimethylhexane
7.5	n-Butane	---	2,3,4-Trimethylpentane
---	1-Butene	2.5	Toluene
---	i-Butene	---	2,3-Dimethylhexane
1.0	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
3.5	i-Pentane	0.5	n-Octane
3.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	0.5	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.0	8
Σ Aromatic	6.5	11
Σ Paraffin	48.5	80
Acetylene	1.5	2
	61	

TABLE C25. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-1-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
2.0	Ethane	0.5	2,3-Dimethylpentane
0.5	Ethylene	---	3-Methylhexane
0.5	Acetylene	---	2,2,3-Trimethylpentane
12.5	Propane	0.5	n-Heptane
2.0	Propene	---	Methylcyclohexane
0.5	i-Butane	---	2,4-Dimethylhexane
2.0	n-Butane	---	2,3,4-Trimethylpentane
---	1-Butene	0.5	Toluene
---	i-Butene	---	2,3-Dimethylhexane
0.5	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
1.0	i-Pentane	---	n-Octane
1.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	0.5	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
0.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
0.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.0	10
Σ Aromatic	4.5	14
Σ Paraffin	23.0	74
Acetylene	0.5	2
	31	

TABLE C26. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED NORTH OF REFINERY AT FENCELINE ON 7-1-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
23.0	Ethane	13.5	2,3-Dimethylpentane
2.0	Ethylene	8.0	3-Methylhexane
1.0	Acetylene	3.0	2,2,3-Trimethylpentane
161	Propane	9.0	n-Heptane
5.0	Propene	10.0	Methylcyclohexane
33.0	i-Butane	1.5	2,4-Dimethylhexane
101	n-Butane	1.0	2,3,4-Trimethylpentane
0.5	1-Butene	27.0	Toluene
2.0	i-Butene	1.5	2,3-Dimethylhexane
2.0	t-2-Butene	5.0	2-Methylheptane
---	c-2-Butene	4.0	3-Ethylhexane
99.0	i-Pentane	6.0	n-Octane
42.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	*	Ethylbenzene
---	t-2-Pentene	*	p & m-Xylene
---	c-2-Pentene	*	Styrene
---	Cyclopentene	*	o-Xylene
---	Cyclopentane	*	n-Nonane
---	2,3-Dimethylbutane	*	i-Propylbenzene
21.0	2-Methylpentane	*	n-Propylbenzene
---	c-4-Methyl-2-pentene	*	p-Ethyltoluene
12.5	3-Methylpentane	*	m-Ethyltoluene
---	1-Hexene	*	o-Ethyltoluene
14.0	n-Hexane	*	1,3,5-Trimethylbenzene
---	t-2-Hexene	*	1,2,4-Trimethylbenzene
---	c-2-Hexene	*	1,2,3-Trimethylbenzene
13.5	Methylcyclopentane	*	Methylstyrene
3.5	2,4-Dimethylpentane	*	1,3-Diethylbenzene
5.5	Benzene	*	1,4-Diethylbenzene
5.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	11.5	1
Σ Aromatic	187	24
Σ Paraffin	586	75
Acetylene	1.0	-
	785	

* missing value

TABLE C27. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED NORTH OF REFINERY AT FENCELINE ON 7-1-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
16.0	Ethane	15.5	2,3-Dimethylpentane
2.5	Ethylene	9.5	3-Methylhexane
0.5	Acetylene	5.5	2,2,3-Trimethylpentane
231	Propane	9.5	n-Heptane
2.5	Propene	10.5	Methylcyclohexane
45.0	i-Butane	1.5	2,4-Dimethylhexane
156	n-Butane	1.0	2,3,4-Trimethylpentane
0.5	1-Butene	92.0	Toluene
1.5	i-Butene	2.5	2,3-Dimethylhexane
1.5	t-2-Butene	6.0	2-Methylheptane
2.0	c-2-Butene	4.5	3-Ethylhexane
141	i-Pentane	4.5	n-Octane
59.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	1.5	Ethylbenzene
---	t-2-Pentene	6.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	23.0	o-Xylene
---	Cyclopentane	*	n-Nonane
---	2,3-Dimethylbutane	*	i-Propylbenzene
30.0	2-Methylpentane	*	n-Propylbenzene
---	c-4-Methyl-2-pentene	*	p-Ethyltoluene
17.0	3-Methylpentane	*	m-Ethyltoluene
---	1-Hexene	*	o-Ethyltoluene
18.5	n-Hexane	*	1,3,5-Trimethylbenzene
---	t-2-Hexene	*	1,2,4-Trimethylbenzene
---	c-2-Hexene	*	1,2,3-Trimethylbenzene
17.5	Methylcyclopentane	*	Methylstyrene
4.0	2,4-Dimethylpentane	*	1,3-Diethylbenzene
7.0	Benzene	*	1,4-Diethylbenzene
6.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	10.5	1
Σ Aromatic	139	15
Σ Paraffin	811	84
Acetylene	0.5	-
	961	

* missing value

TABLE C28. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-2-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
4.5	Ethane	0.5	2,3-Dimethylpentane
---	Ethylene	---	3-Methylhexane
---	Acetylene	---	2,2,3-Trimethylpentane
14.0	Propane	0.5	n-Heptane
2.0	Propene	---	Methylcyclohexane
2.0	i-Butane	---	2,4-Dimethylhexane
6.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.0	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
3.0	i-Pentane	---	n-Octane
2.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
0.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	6
Σ Aromatic	3.5	8
Σ Paraffin	37.0	86
Acetylene	---	-
	43	

TABLE C29. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-2-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
12.0	Ethane	33.5	2,3-Dimethylpentane
4.0	Ethylene	19.5	3-Methylhexane
2.0	Acetylene	13.5	2,2,3-Trimethylpentane
116	Propane	35.5	n-Heptane
3.5	Propene	41.0	Methylcyclohexane
59.0	i-Butane	4.0	2,4-Dimethylhexane
353	n-Butane	4.0	2,3,4-Trimethylpentane
0.5	1-Butene	32.0	Toluene
5.0	i-Butene	4.5	2,3-Dimethylhexane
4.0	t-2-Butene	19.5	2-Methylheptane
7.0	c-2-Butene	16.5	3-Ethylhexane
232	i-Pentane	19.5	n-Octane
105	n-Pentane	---	Ethylcyclohexane
3.5	1-Pentene	9.5	Ethylbenzene
---	t-2-Pentene	24.5	p & m-Xylene
---	c-2-Pentene	5.0	Styrene
---	Cyclopentene	10.0	o-Xylene
---	Cyclopentane	12.0	n-Nonane
---	2,3-Dimethylbutane	2.0	i-Propylbenzene
54.5	2-Methylpentane	4.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	7.5	p-Ethyltoluene
31.5	3-Methylpentane	4.0	m-Ethyltoluene
---	1-Hexene	5.0	o-Ethyltoluene
49.0	n-Hexane	6.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	11.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
35.5	Methylcyclopentane	---	Methylstyrene
8.0	2,4-Dimethylpentane	3.0	1,3-Diethylbenzene
12.5	Benzene	1.0	1,4-Diethylbenzene
19.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	27.5	2
Σ Aromatic	140	10
Σ Paraffin	1297	88
Acetylene	2.0	-
	1467	

TABLE C30. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-2-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
204	Ethane	40.5	2,3-Dimethylpentane
40.0	Ethylene	25.5	3-Methylhexane
1.0	Acetylene	15.0	2,2,3-Trimethylpentane
860	Propane	26.5	n-Heptane
11.5	Propene	28.5	Methylcyclohexane
165	i-Butane	4.5	2,4-Dimethylhexane
532	n-Butane	3.0	2,3,4-Trimethylpentane
0.5	1-Butene	35.5	Toluene
8.0	i-Butene	1.5	2,3-Dimethylhexane
12.0	t-2-Butene	13.0	2-Methylheptane
15.0	c-2-Butene	11.0	3-Ethylhexane
480	i-Pentane	8.5	n-Octane
189	n-Pentane	---	Ethylcyclohexane
23.5	1-Pentene	6.0	Ethylbenzene
---	t-2-Pentene	18.0	p & m-Xylene
---	c-2-Pentene	3.0	Styrene
---	Cyclopentene	6.5	o-Xylene
---	Cyclopentane	4.0	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
89.5	2-Methylpentane	2.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	5.0	p-Ethyltoluene
49.5	3-Methylpentane	3.0	m-Ethyltoluene
---	1-Hexene	3.5	o-Ethyltoluene
---	n-Hexane	3.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	8.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
53.0	Methylcyclopentane	---	Methylstyrene
47.5	2,4-Dimethylpentane	2.0	1,3-Diethylbenzene
17.5	Benzene	2.0	1,4-Diethylbenzene
16.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	111	1
Σ Aromatic	130	2
Σ Paraffin	8057	97
Acetylene	1.0	-
	8300	

TABLE C31. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT THE WSU TRAILER ON 7-2-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
15.5	Ethane	4.0	2,3-Dimethylpentane
9.0	Ethylene	2.0	3-Methylhexane
3.0	Acetylene	2.0	2,2,3-Trimethylpentane
48.0	Propane	2.5	n-Heptane
13.5	Propene	3.0	Methylcyclohexane
11.0	i-Butane	0.5	2,4-Dimethylhexane
44.5	n-Butane	---	2,3,4-Trimethylpentane
6.5	1-Butene	6.0	Toluene
1.0	i-Butene	---	2,3-Dimethylhexane
0.5	t-2-Butene	1.0	2-Methylheptane
0.5	c-2-Butene	1.0	3-Ethylhexane
25.5	i-Pentane	1.0	n-Octane
14.0	n-Pentane	---	Ethylcyclohexane
1.5	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	0.5	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
7.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
4.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
5.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
5.0	Methylcyclopentane	---	Methylstyrene
1.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
2.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	32.5	13
Σ Aromatic	15.0	6
Σ Paraffin	201	80
Acetylene	3.0	1
	251	

TABLE C32. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 1 MILE DOWNWIND OF REFINERY ON 7-3-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
46.0	Ethane	17.0	2,3-Dimethylpentane
11.5	Ethylene	8.0	3-Methylhexane
1.5	Acetylene	8.5	2,2,3-Trimethylpentane
90.0	Propane	14.5	n-Heptane
42.0	Propene	16.0	Methylcyclohexane
43.5	i-Butane	2.0	2,4-Dimethylhexane
60.0	n-Butane	3.0	2,3,4-Trimethylpentane
11.0	1-Butene	18.0	Toluene
12.0	i-Butene	1.0	2,3-Dimethylhexane
10.5	t-2-Butene	2.0	2-Methylheptane
---	c-2-Butene	6.5	3-Ethylhexane
56.5	i-Pentane	6.0	n-Octane
30.0	n-Pentane	---	Ethylcyclohexane
3.0	1-Pentene	3.0	Ethylbenzene
---	t-2-Pentene	6.0	p & m-Xylene
---	c-2-Pentene	2.0	Styrene
---	Cyclopentene	2.0	o-Xylene
---	Cyclopentane	4.0	n-Nonane
---	2,3-Dimethylbutane	1.0	i-Propylbenzene
17.0	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.5	p-Ethyltoluene
10.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
18.0	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	2.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
15.5	Methylcyclopentane	---	Methylstyrene
5.0	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
6.0	Benzene	0.5	1,4-Diethylbenzene
8.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	90.0	14
Σ Aromatic	50.0	8
Σ Paraffin	489	78
Acetylene	1.5	-
	630	

TABLE C33. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF REFINERY AT FENCELINE ON 7-3-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
111	Ethane	653	2,3-Dimethylpentane
7.5	Ethylene	355	3-Methylhexane
2.5	Acetylene	260	2,2,3-Trimethylpentane
190	Propane	323	n-Heptane
9.0	Propene	283	Methylcyclohexane
704	i-Butane	88	2,4-Dimethylhexane
3550	n-Butane	55	2,3,4-Trimethylpentane
0.5	1-Butene	616	Toluene
32.0	i-Butene	46.0	2,3-Dimethylhexane
19.5	t-2-Butene	129	2-Methylheptane
43.5	c-2-Butene	103	3-Ethylhexane
3821	i-Pentane	85.5	n-Octane
1568	n-Pentane	---	Ethylcyclohexane
150	1-Pentene	92.5	Ethylbenzene
---	t-2-Pentene	328	p & m-Xylene
---	c-2-Pentene	31.0	Styrene
---	Cyclopentene	102	o-Xylene
---	Cyclopentane	33.0	n-Nonane
---	2,3-Dimethylbutane	7.0	i-Propylbenzene
1352	2-Methylpentane	28.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	60.0	p-Ethyltoluene
777	3-Methylpentane	33.5	m-Ethyltoluene
---	1-Hexene	41.0	o-Ethyltoluene
759	n-Hexane	37.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	90.5	1,2,4-Trimethylbenzene
746	c-2-Hexene	---	1,2,3-Trimethylbenzene
194	Methylcyclopentane	---	Methylstyrene
324	2,4-Dimethylpentane	15.0	1,3-Diethylbenzene
217	Benzene	16.0	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	262	1
Σ Aromatic	1722	10
Σ Paraffin	16042	89
Acetylene	2.5	-
	18028	

TABLE C33. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF REFINERY AT FENCELINE ON 7-3-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
111	Ethane	653	2,3-Dimethylpentane
7.5	Ethylene	355	3-Methylhexane
2.5	Acetylene	260	2,2,3-Trimethylpentane
190	Propane	323	n-Heptane
9.0	Propene	283	Methylcyclohexane
704	i-Butane	88	2,4-Dimethylhexane
3550	n-Butane	55	2,3,4-Trimethylpentane
0.5	1-Butene	616	Toluene
32.0	i-Butene	46.0	2,3-Dimethylhexane
19.5	t-2-Butene	129	2-Methylheptane
43.5	c-2-Butene	103	3-Ethylhexane
3821	i-Pentane	85.5	n-Octane
1568	n-Pentane	---	Ethylcyclohexane
150	1-Pentene	92.5	Ethylbenzene
---	t-2-Pentene	328	p & m-Xylene
---	c-2-Pentene	31.0	Styrene
---	Cyclopentene	102	o-Xylene
---	Cyclopentane	33.0	n-Nonane
---	2,3-Dimethylbutane	7.0	i-Propylbenzene
1352	2-Methylpentane	28.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	60.0	p-Ethyltoluene
777	3-Methylpentane	33.5	m-Ethyltoluene
---	1-Hexene	41.0	o-Ethyltoluene
759	n-Hexane	37.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	90.5	1,2,4-Trimethylbenzene
746	c-2-Hexene	---	1,2,3-Trimethylbenzene
194	Methylcyclopentane	---	Methylstyrene
324	2,4-Dimethylpentane	15.0	1,3-Diethylbenzene
217	Benzene	16.0	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	μg/m^3	%
Σ Olefin	262	1
Σ Aromatic	1722	10
Σ Paraffin	16042	89
Acetylene	2.5	-
	18028	

TABLE C34. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-3-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
3.5	Ethane	1.5	2,3-Dimethylpentane
3.0	Ethylene	1.0	3-Methylhexane
3.0	Acetylene	1.0	2,2,3-Trimethylpentane
5.0	Propane	1.0	n-Heptane
1.5	Propene	1.0	Methylcyclohexane
2.0	i-Butane	0.5	2,4-Dimethylhexane
9.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	2.0	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
6.5	i-Pentane	0.5	n-Octane
3.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	0.5	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.0	5
Σ Aromatic	9.0	15
Σ Paraffin	44.5	75
Acetylene	3.0	5
	59	

TABLE C35. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-3-77

ug/m^3	**Hydrocarbon**	ug/m^3	**Hydrocarbon**
5.0	**Ethane**	1.0	**2,3-Dimethylpentane**
*	**Ethylene**	0.5	**3-Methylhexane**
0.5	**Acetylene**	1.0	**2,2,3-Trimethylpentane**
17.5	**Propane**	0.5	**n-Heptane**
2.5	**Propene**	0.5	**Methylcyclohexane**
3.0	**i-Butane**	---	**2,4-Dimethylhexane**
11.5	**n-Butane**	---	**2,3,4-Trimethylpentane**
0.5	**1-Butene**	2.0	**Toluene**
---	**i-Butene**	---	**2,3-Dimethylhexane**
0.5	**t-2-Butene**	---	**2-Methylheptane**
---	**c-2-Butene**	---	**3-Ethylhexane**
7.5	**i-Pentane**	---	**n-Octane**
4.0	**n-Pentane**	---	**Ethylcyclohexane**
0.5	**1-Pentene**	0.5	**Ethylbenzene**
---	**t-2-Pentene**	0.5	**p & m-Xylene**
---	**c-2-Pentene**	0.5	**Styrene**
---	**Cyclopentene**	0.5	**o-Xylene**
---	**Cyclopentane**	---	**n-Nonane**
---	**2,3-Dimethylbutane**	---	**i-Propylbenzene**
1.5	**2-Methylpentane**	---	**n-Propylbenzene**
---	**c-4-Methyl-2-pentene**	---	**p-Ethyltoluene**
1.0	**3-Methylpentane**	---	**m-Ethyltoluene**
---	**1-Hexene**	---	**o-Ethyltoluene**
1.0	**n-Hexane**	---	**1,3,5-Trimethylbenzene**
---	**t-2-Hexene**	0.5	**1,2,4-Trimethylbenzene**
---	**c-2-Hexene**	---	**1,2,3-Trimethylbenzene**
1.0	**Methylcyclopentane**	---	**Methylstyrene**
0.5	**2,4-Dimethylpentane**	---	**1,3-Diethylbenzene**
1.0	**Benzene**	---	**1,4-Diethylbenzene**
---	**Cyclohexane**		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	4.0	6
Σ Aromatic	53.5	85
Σ Paraffin	5.5	9
Acetylene	0.5	1
	63	

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* missing value

TABLE C36. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-4-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.5	Ethane	0.5	2,3-Dimethylpentane
*	Ethylene	0.5	3-Methylhexane
1.0	Acetylene	0.5	2,2,3-Trimethylpentane
6.0	Propane	---	n-Heptane
1.0	Propene	---	Methylcyclohexane
1.0	i-Butane	---	2,4-Dimethylhexane
5.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
3.0	i-Pentane	---	n-Octane
2.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	6
Σ Aromatic	6.0	15
Σ Paraffin	30.5	76
Acetylene	1.0	3
	40	

* missing value

TABLE C37. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-4-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.0	Ethane	1.0	2,3-Dimethylpentane
5.5	Ethylene	1.0	3-Methylhexane
1.0	Acetylene	0.5	2,2,3-Trimethylpentane
10.0	Propane	1.0	n-Heptane
1.0	Propene	1.0	Methylcyclohexane
3.0	i-Butane	---	2,4-Dimethylhexane
10.0	n-Butane	---	2,3,4-Trimethylpentane
1.0	1-Butene	2.0	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
5.0	i-Pentane	0.5	n-Octane
4.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
2.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
2.0	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	7.5	11
Σ Aromatic	6.0	9
Σ Paraffin	51.5	78
Acetylene	1.0	2
	66	

TABLE C38. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED ALONG FENCELINE NE OF REFINERY ON 7-4-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
11.0	Ethane	28.5	2,3-Dimethylpentane
4.0	Ethylene	18.5	3-Methylhexane
---	Acetylene	17.0	2,2,3-Trimethylpentane
48.0	Propane	39.0	n-Heptane
2.5	Propene	42.0	Methylcyclohexane
56.0	i-Butane	4.5	2,4-Dimethylhexane
260	n-Butane	1.5	2,3,4-Trimethylpentane
1.5	1-Butene	17.5	Toluene
2.5	i-Butene	3.5	2,3-Dimethylhexane
2.0	t-2-Butene	16.5	2-Methylheptane
1.5	c-2-Butene	14.0	3-Ethylhexane
187	i-Pentane	18.5	n-Octane
107	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	7.0	Ethylbenzene
---	t-2-Pentene	14.0	p & m-Xylene
---	c-2-Pentene	4.0	Styrene
---	Cyclopentene	5.0	o-Xylene
---	Cyclopentane	9.5	n-Nonane
---	2,3-Dimethylbutane	1.5	i-Propylbenzene
47.0	2-Methylpentane	1.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
28.0	3-Methylpentane	2.0	m-Ethyltoluene
---	1-Hexene	2.0	o-Ethyltoluene
52.0	n-Hexane	2.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	3.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
37.0	Methylcyclopentane	---	Methylstyrene
6.0	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
8.5	Benzene	1.0	1,4-Diethylbenzene
22.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	14.0	1
Σ Aromatic	71.0	6
Σ Paraffin	1074	93
Acetylene	---	-
	1159	

TABLE C39. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 1 MILE DOWNWIND OF REFINERY ON 7-4-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
19.5	Ethane	3.0	2,3-Dimethylpentane
16.5	Ethylene	2.0	3-Methylhexane
0.5	Acetylene	2.0	2,2,3-Trimethylpentane
36.5	Propane	3.0	n-Heptane
6.0	Propene	3.5	Methylcyclohexane
9.0	i-Butane	0.5	2,4-Dimethylhexane
24.0	n-Butane	---	2,3,4-Trimethylpentane
1.0	1-Butene	4.0	Toluene
2.0	i-Butene	0.5	2,3-Dimethylhexane
1.5	t-2-Butene	1.5	2-Methylheptane
1.0	c-2-Butene	1.0	3-Ethylhexane
18.0	i-Pentane	1.5	n-Octane
11.5	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
5.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
3.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
5.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
3.5	Methylcyclopentane	---	Methylstyrene
1.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
2.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	29	14
Σ Aromatic	11.5	6
Σ Paraffin	162	80
Acetylene	0.5	-
	203	

TABLE C40. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 1.5 MILES DOWNWIND OF REFINERY ON 7-5-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
30.5	Ethane	21.5	2,3-Dimethylpentane
9.0	Ethylene	11.5	3-Methylhexane
1.5	Acetylene	8.0	2,2,3-Trimethylpentane
61.0	Propane	14.0	n-Heptane
4.5	Propene	12.0	Methylcyclohexane
27.0	i-Butane	2.0	2,4-Dimethylhexane
124	n-Butane	2.0	2,3,4-Trimethylpentane
0.5	1-Butene	48.5	Toluene
2.0	i-Butene	3.0	2,3-Dimethylhexane
1.5	t-2-Butene	7.0	2-Methylheptane
1.0	c-2-Butene	5.5	3-Ethylhexane
100	i-Pentane	4.5	n-Octane
49.0	n-Pentane	---	Ethylcyclohexane
4.0	1-Pentene	4.0	Ethylbenzene
---	t-2-Pentene	10.0	p & m-Xylene
---	c-2-Pentene	1.5	Styrene
---	Cyclopentene	3.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
37.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
22.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	1.5	o-Ethyltoluene
27.0	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	2.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
22.0	Methylcyclopentane	---	Methylstyrene
6.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
9.5	Benzene	---	1,4-Diethylbenzene
9.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	22.5	3
Σ Aromatic	83.5	12
Σ Paraffin	606	85
Acetylene	1.5	-
	713	

TABLE C41. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 1.5 MILES DOWNWIND OF REFINERY ON 7-5-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
23.5	Ethane	4.0	2,3-Dimethylpentane
5.0	Ethylene	2.0	3-Methylhexane
0.5	Acetylene	1.0	2,2,3-Trimethylpentane
38.5	Propane	3.0	n-Heptane
3.0	Propene	2.5	Methylcyclohexane
11.0	i-Butane	0.5	2,4-Dimethylhexane
47.0	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	11.0	Toluene
1.0	i-Butene	0.5	2,3-Dimethylhexane
1.0	t-2-Butene	1.0	2-Methylheptane
0.5	c-2-Butene	1.0	3-Ethylhexane
26.5	i-Pentane	1.0	n-Octane
15.0	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
8.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
4.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
6.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
5.5	Methylcyclopentane	---	Methylstyrene
1.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.5	Benzene	---	1,4-Diethylbenzene
2.0	Cyclohexane		

Total Identified Hydrocarbons	μg/m^3	%
Σ Olefin	10.5	4
Σ Aromatic	18.0	8
Σ Paraffin	206	88
Acetylene	0.5	-
	235	

TABLE C42. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER ON 7-5-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
26.0	Ethane	4.5	2,3-Dimethylpentane
9.0	Ethylene	2.5	3-Methylhexane
1.0	Acetylene	1.5	2,2,3-Trimethylpentane
43.0	Propane	4.5	n-Heptane
4.0	Propene	3.0	Methylcyclohexane
10.0	i-Butane	0.5	2,4-Dimethylhexane
35.0	n-Butane	0.5	2,3,4-Trimethylpentane
---	1-Butene	13.0	Toluene
10.0	i-Butene	---	2,3-Dimethylhexane
1.0	t-2-Butene	1.5	2-Methylheptane
0.5	c-2-Butene	1.5	3-Ethylhexane
24.5	i-Pentane	2.0	n-Octane
15.5	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	2.0	Ethylbenzene
---	t-2-Pentene	6.5	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	2.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
9.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	2.0	p-Ethyltoluene
4.5	3-Methylpentane	1.5	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
7.5	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
5.0	Methylcyclopentane	---	Methylstyrene
1.0	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
3.0	Benzene	0.5	1,4-Diethylbenzene
2.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	25.5	9
Σ Aromatic	42.5	16
Σ Paraffin	205	75
Acetylene	1.0	-
	274	

TABLE C43. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-5-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
6.0	Ethane	1.5	2,3-Dimethylpentane
5.0	Ethylene	0.5	3-Methylhexane
1.0	Acetylene	0.5	2,2,3-Trimethylpentane
10.0	Propane	1.0	n-Heptane
1.5	Propene	1.0	Methylcyclohexane
3.0	i-Butane	---	2,4-Dimethylhexane
9.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	2.0	Toluene
0.5	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
5.5	i-Pentane	---	n-Octane
3.0	n-Pentane	---	Ethylcyclohexane
1.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
3.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
2.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.5	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	9.0	12
Σ Aromatic	7.0	9
Σ Paraffin	57.0	77
Acetylene	1.0	1
	74	

TABLE C44. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT N CLAY AND E MAIN IN ROBINSON ON 7-5-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
4.5	Ethane	1.0	2,3-Dimethylpentane
2.5	Ethylene	0.5	3-Methylhexane
3.0	Acetylene	0.5	2,2,3-Trimethylpentane
8.0	Propane	0.5	n-Heptane
2.0	Propene	---	Methylcyclohexane
2.0	i-Butane	---	2,4-Dimethylhexane
8.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
4.0	i-Pentane	---	n-Octane
2.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.5	11
Σ Aromatic	5.0	10
Σ Paraffin	37	74
Acetylene	3.0	6
	50	

TABLE C45. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED IN OIL FIELD WEST OF ROBINSON ON 7-5-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
11.5	Ethane	10.0	2,3-Dimethylpentane
1.0	Ethylene	5.5	3-Methylhexane
0.5	Acetylene	3.5	2,2,3-Trimethylpentane
101	Propane	5.5	n-Heptane
4.0	Propene	4.5	Methylcyclohexane
71.0	i-Butane	1.0	2,4-Dimethylhexane
275	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	8.0	Toluene
1.0	i-Butene	1.0	2,3-Dimethylhexane
3.0	t-2-Butene	1.5	2-Methylheptane
6.0	c-2-Butene	1.0	3-Ethylhexane
174	i-Pentane	1.0	n-Octane
78.0	n-Pentane	---	Ethylcyclohexane
6.5	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
36.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
19.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
19.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
17.5	Methylcyclopentane	---	Methylstyrene
3.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
8.0	Benzene	---	1,4-Diethylbenzene
5.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	22.0	3
Σ Aromatic	21.5	2
Σ Paraffin	847	95
Acetylene	0.5	-
	891	

TABLE C46. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-6-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
8.5	Ethane	0.5	2,3-Dimethylpentane
*	Ethylene	0.5	3-Methylhexane
1.0	Acetylene	---	2,2,3-Trimethylpentane
10.0	Propane	0.5	n-Heptane
1.0	Propene	---	Methylcyclohexane
2.0	i-Butane	---	2,4-Dimethylhexane
8.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
0.5	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
5.0	i-Pentane	0.5	n-Octane
3.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	5
Σ Aromatic	5.0	10
Σ Paraffin	41.4	83
Acetylene	1.0	2
	50	

* missing value

TABLE C47. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-6-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
11.5	Ethane	1.0	2,3-Dimethylpentane
3.5	Ethylene	0.5	3-Methylhexane
---	Acetylene	0.5	2,2,3-Trimethylpentane
13.0	Propane	1.0	n-Heptane
1.5	Propene	1.0	Methylcyclohexane
4.0	i-Butane	---	2,4-Dimethylhexane
15.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	4.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
6.5	i-Pentane	0.5	n-Octane
6.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
2.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.5	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	6.0	7
Σ Aromatic	9.5	11
Σ Paraffin	69.0	82
Acetylene	---	-
	84	

TABLE C48. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-6-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
66.5	Ethane	40.0	2,3-Dimethylpentane
5.0	Ethylene	20.0	3-Methylhexane
---	Acetylene	15.5	2,2,3-Trimethylpentane
52.1	Propane	25.0	n-Heptane
6.5	Propene	23.0	Methylcyclohexane
116	i-Butane	3.0	2,4-Dimethylhexane
354	n-Butane	2.5	2,3,4-Trimethylpentane
1.0	1-Butene	162	Toluene
9.5	i-Butene	8.0	2,3-Dimethylhexane
---	t-2-Butene	13.0	2-Methylheptane
---	c-2-Butene	15.0	3-Ethylhexane
613	i-Pentane	13.0	n-Octane
271	n-Pentane	---	Ethylcyclohexane
18.0	1-Pentene	6.0	Ethylbenzene
27.5	t-2-Pentene	15.0	p & m-Xylene
36.0	c-2-Pentene	4.0	Styrene
21.0	Cyclopentene	5.5	o-Xylene
---	Cyclopentane	1.5	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
130	2-Methylpentane	2.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	2.0	p-Ethyltoluene
71.5	3-Methylpentane	1.0	m-Ethyltoluene
---	1-Hexene	2.5	o-Ethyltoluene
81.5	n-Hexane	3.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	5.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
61.0	Methylcyclopentane	---	Methylstyrene
14.0	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
15.5	Benzene	1.5	1,4-Diethylbenzene
20.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	58.5	2
Σ Aromatic	224	10
Σ Paraffin	2013	88
Acetylene	---	-
	2300	

TABLE C49. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-6-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
51.0	Ethane	46.0	2,3-Dimethylpentane
5.5	Ethylene	22.5	3-Methylhexane
1.5	Acetylene	24.5	2,2,3-Trimethylpentane
136	Propane	23.0	n-Heptane
10.0	Propene	18.0	Methylcyclohexane
111	i-Butane	3.5	2,4-Dimethylhexane
745	n-Butane	3.5	2,3,4-Trimethylpentane
1.0	1-Butene	53.5	Toluene
11.0	i-Butene	5.0	2,3-Dimethylhexane
8.5	t-2-Butene	10.0	2-Methylheptane
12.0	c-2-Butene	11.5	3-Ethylhexane
433	i-Pentane	9.5	n-Octane
151	n-Pentane	---	Ethylcyclohexane
12.0	1-Pentene	10.0	Ethylbenzene
---	t-2-Pentene	29.0	p & m-Xylene
---	c-2-Pentene	3.5	Styrene
---	Cyclopentene	10.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	1.0	i-Propylbenzene
79.5	2-Methylpentane	3.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	3.5	p-Ethyltoluene
45.0	3-Methylpentane	4.0	m-Ethyltoluene
---	1-Hexene	3.5	o-Ethyltoluene
48.0	n-Hexane	2.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	6.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
42.5	Methylcyclopentane	---	Methylstyrene
16.0	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
20.0	Benzene	1.0	1,4-Diethylbenzene
14.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	60.0	3
Σ Aromatic	152	7
Σ Paraffin	2050	90
Acetylene	1.5	-
	2263	

TABLE C50. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-7-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
5.0	Ethane	0.5	2,3-Dimethylpentane
4.0	Ethylene	0.5	3-Methylhexane
1.0	Acetylene	0.5	2,2,3-Trimethylpentane
6.0	Propane	0.5	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
2.0	i-Butane	---	2,4-Dimethylhexane
6.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
3.0	i-Pentane	---	n-Octane
2.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
1.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.5	13
Σ Aromatic	6.5	15
Σ Paraffin	30.5	71
Acetylene	1.0	2
	43	

TABLE C51. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER DURING FUMIGATION BY REFINERY PLUME ON 7-7-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
33.0	Ethane	9.5	2,3-Dimethylpentane
6.5	Ethylene	6.5	3-Methylhexane
1.5	Acetylene	1.5	2,2,3-Trimethylpentane
69.5	Propane	9.0	n-Heptane
5.0	Propene	6.5	Methylcyclohexane
17.5	i-Butane	1.5	2,4-Dimethylhexane
66.5	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	26.0	Toluene
1.5	i-Butene	1.5	2,3-Dimethylhexane
1.0	t-2-Butene	6.0	2-Methylheptane
0.5	c-2-Butene	5.0	3-Ethylhexane
48.0	i-Pentane	4.5	n-Octane
25.0	n-Pentane	---	Ethylcyclohexane
2.0	1-Pentene	3.5	Ethylbenzene
---	t-2-Pentene	9.0	p & m-Xylene
---	c-2-Pentene	2.0	Styrene
---	Cyclopentene	3.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
12.5	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.5	p-Ethyltoluene
7.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
10.0	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
8.0	Methylcyclopentane	---	Methylstyrene
2.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
4.0	Benzene	0.5	1,4-Diethylbenzene
3.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	17.0	4
Σ Aromatic	53.0	12
Σ Paraffin	355	84
Acetylene	1.5	-
	426	

TABLE C52. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-7-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
21.0	Ethane	41.5	2,3-Dimethylpentane
20.0	Ethylene	23.0	3-Methylhexane
4.0	Acetylene	14.0	2,2,3-Trimethylpentane
108	Propane	23.5	n-Heptane
3.5	Propene	18.0	Methylcyclohexane
102	i-Butane	3.5	2,4-Dimethylhexane
584	n-Butane	3.0	2,3,4-Trimethylpentane
0.5	1-Butene	51.0	Toluene
6.5	i-Butene	1.5	2,3-Dimethylhexane
4.5	t-2-Butene	4.0	2-Methylheptane
8.0	c-2-Butene	11.0	3-Ethylhexane
387	i-Pentane	9.0	n-Octane
150	n-Pentane	---	Ethylcyclohexane
4.0	1-Pentene	9.5	Ethylbenzene
---	t-2-Pentene	25.5	p & m-Xylene
---	c-2-Pentene	3.0	Styrene
---	Cyclopentene	9.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	1.0	i-Propylbenzene
92.5	2-Methylpentane	1.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	3.5	p-Ethyltoluene
53.0	3-Methylpentane	3.0	m-Ethyltoluene
---	1-Hexene	3.0	o-Ethyltoluene
55.0	n-Hexane	2.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	7.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
47.0	Methylcyclopentane	---	Methylstyrene
13.0	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
22.0	Benzene	---	1,4-Diethylbenzene
15.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	47.0	2
Σ Aromatic	143	7
Σ Paraffin	1779	91
Acetylene	4.0	-
	1973	

TABLE C53. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-7-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
89.5	Ethane	36.5	2,3-Dimethylpentane
11.0	Ethylene	20.5	3-Methylhexane
12.0	Acetylene	12.0	2,2,3-Trimethylpentane
166	Propane	27.5	n-Heptane
17.0	Propene	20.5	Methylcyclohexane
57.0	i-Butane	4.0	2,4-Dimethylhexane
228	n-Butane	3.5	2,3,4-Trimethylpentane
1.0	1-Butene	51.5	Toluene
7.0	i-Butene	4.0	2,3-Dimethylhexane
5.5	t-2-Butene	14.0	2-Methylheptane
6.0	c-2-Butene	11.4	3-Ethylhexane
191	i-Pentane	11.0	n-Octane
90.5	n-Pentane	---	Ethylcyclohexane
1.5	1-Pentene	11.0	Ethylbenzene
---	t-2-Pentene	29.0	p & m-Xylene
---	c-2-Pentene	4.0	Styrene
---	Cyclopentene	11.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	1.0	i-Propylbenzene
59.5	2-Methylpentane	3.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	5.5	p-Ethyltoluene
35.0	3-Methylpentane	3.0	m-Ethyltoluene
---	1-Hexene	4.5	o-Ethyltoluene
43.0	n-Hexane	3.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	8.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
36.5	Methylcyclopentane	---	Methylstyrene
9.5	2,4-Dimethylpentane	1.5	1,3-Diethylbenzene
21.0	Benzene	2.0	1,4-Diethylbenzene
14.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	49.0	3
Σ Aromatic	161	12
Σ Paraffin	1185	84
Acetylene	12.0	1
	1407	

TABLE C54. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-8-77

ug/m³	Hydrocarbon	ug/m³	Hydrocarbon
6.0	Ethane		
*	Ethylene	1.0	2,3-Dimethylpentane
1.5	Acetylene	0.5	3-Methylhexane
19.5	Propane	0.5	2,2,3-Trimethylpentane
2.5	Propene	0.5	n-Heptane
3.5	i-Butane	0.5	Methylcyclohexane
14.0	n-Butane	---	2,4-Dimethylhexane
---	1-Butene	---	2,3,4-Trimethylpentane
---	i-Butene	2.5	Toluene
---	t-2-Butene	---	2,3-Dimethylhexane
---	c-2-Butene	0.5	2-Methylheptane
9.5	i-Pentane	---	3-Ethylhexane
5.0	n-Pentane	0.5	n-Octane
---	1-Pentene	---	Ethylcyclohexane
---	t-2-Pentene	0.5	Ethylbenzene
---	c-2-Pentene	1.0	p & m-Xylene
---	Cyclopentene	---	Styrene
---	Cyclopentane	0.5	o-Xylene
---	2,3-Dimethylbutane	---	n-Nonane
2.0	2-Methylpentane	---	i-Propylbenzene
---	c-4-Methyl-2-pentene	---	n-Propylbenzene
1.5	3-Methylpentane	---	p-Ethyltoluene
---	1-Hexene	---	m-Ethyltoluene
1.5	n-Hexane	---	o-Ethyltoluene
---	t-2-Hexene	---	1,3,5-Trimethylbenzene
---	c-2-Hexene	---	1,2,4-Trimethylbenzene
1.0	Methylcyclopentane	---	1,2,3-Trimethylbenzene
0.5	2,4-Dimethylpentane	---	Methylstyrene
1.5	Benzene	---	1,3-Diethylbenzene
0.5	Cyclohexane	---	1,4-Diethylbenzene

Total Identified Hydrocarbons	ug/m³	%
Σ Olefin	3.0	4
Σ Aromatic	5.5	7
Σ Paraffin	68.5	88
Acetylene	1.5	1
	78	

* missing value

TABLE C55. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 0.5 MILES DOWNWIND OF THE REFINERY ON 7-8-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
43.0	Ethane	4.0	2,3-Dimethylpentane
6.5	Ethylene	2.5	3-Methylhexane
3.0	Acetylene	12.0	2,2,3-Trimethylpentane
66.5	Propane	12.5	n-Heptane
7.0	Propene	6.0	Methylcyclohexane
25.5	i-Butane	2.5	2,4-Dimethylhexane
48.0	n-Butane	3.0	2,3,4-Trimethylpentane
---	1-Butene	26.5	Toluene
1.5	i-Butene	---	2,3-Dimethylhexane
1.5	t-2-Butene	3.5	2-Methylheptane
1.5	c-2-Butene	5.0	3-Ethylhexane
49.5	i-Pentane	5.5	n-Octane
19.5	n-Pentane	---	Ethylcyclohexane
2.0	1-Pentene	5.0	Ethylbenzene
---	t-2-Pentene	14.5	p & m-Xylene
---	c-2-Pentene	2.5	Styrene
---	Cyclopentene	10.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
15.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	3.0	p-Ethyltoluene
1.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
12.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	3.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
7.0	Methylcyclopentane	---	Methylstyrene
9.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
6.5	Benzene	---	1,4-Diethylbenzene
6.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	20.0	4
Σ Aromatic	73.0	16
Σ Paraffin	370	79
Acetylene	3.0	1
	466	

TABLE C56. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-8-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
18.0	Ethane	26.0	2,3-Dimethylpentane
4.0	Ethylene	12.0	3-Methylhexane
1.0	Acetylene	15.5	2,2,3-Trimethylpentane
74.5	Propane	18.0	n-Heptane
5.5	Propene	14.0	Methylcyclohexane
60.5	i-Butane	5.5	2,4-Dimethylhexane
252	n-Butane	4.0	2,3,4-Trimethylpentane
---	1-Butene	36.5	Toluene
3.5	i-Butene	4.0	2,3-Dimethylhexane
---	t-2-Butene	12.0	2-Methylheptane
2.5	c-2-Butene	15.0	3-Ethylhexane
179	i-Pentane	15.0	n-Octane
76.0	n-Pentane	---	Ethylcyclohexane
6.0	1-Pentene	11.5	Ethylbenzene
---	t-2-Pentene	25.0	p & m-Xylene
---	c-2-Pentene	7.0	Styrene
---	Cyclopentene	8.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	1.5	i-Propylbenzene
44.5	2-Methylpentane	5.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	4.5	p-Ethyltoluene
25.0	3-Methylpentane	2.0	m-Ethyltoluene
---	1-Hexene	2.0	o-Ethyltoluene
30.0	n-Hexane	5.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	8.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
22.0	Methylcyclopentane	---	Methylstyrene
10.0	2,4-Dimethylpentane	1.5	1,3-Diethylbenzene
9.0	Benzene	---	1,4-Diethylbenzene
9.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	21.5	2
Σ Aromatic	127	12
Σ Paraffin	942	86
Acetylene	1.0	-
	1091	

TABLE C57. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE AT 13,000 FT. OVER ROBINSON ON 7-8-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
1.5	Ethane	2.0	2,3-Dimethylpentane
*	Ethylene	1.0	3-Methylhexane
0.5	Acetylene	1.0	2,2,3-Trimethylpentane
5.0	Propane	0.5	n-Heptane
0.5	Propene	2.0	Methylcyclohexane
0.5	i-Butane	0.5	2,4-Dimethylhexane
1.5	n-Butane	---	2,3,4-Trimethylpentane
---	1-Butene	1.0	Toluene
0.5	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
2.5	i-Pentane	0.5	n-Octane
1.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
0.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
1.0	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	8
Σ Aromatic	15.5	48
Σ Paraffin	14.0	44
Acetylene	0.5	1
	32	

* missing value

TABLE C58. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 10 MILES FROM REFINERY ON 7-8-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
4.0	Ethane		
*	Ethylene	0.5	2,3-Dimethylpentane
0.5	Acetylene	0.5	3-Methylhexane
3.0	Propane	0.5	2,2,3-Trimethylpentane
0.5	Propene	0.5	n-Heptane
1.0	i-Butane	0.5	Methylcyclohexane
3.5	n-Butane	---	2,4-Dimethylhexane
---	1-Butene	---	2,3,4-Trimethylpentane
0.5	i-Butene	1.0	Toluene
---	t-2-Butene	---	2,3-Dimethylhexane
---	c-2-Butene	---	2-Methylheptane
1.5	i-Pentane	---	3-Ethylhexane
1.0	n-Pentane	---	n-Octane
---	1-Pentene	---	Ethylcyclohexane
---	t-2-Pentene	---	Ethylbenzene
---	c-2-Pentene	0.5	p & m-Xylene
---	Cyclopentene	---	Styrene
---	Cyclopentane	1.5	o-Xylene
---	2,3-Dimethylbutane	---	n-Nonane
0.5	2-Metnylpentane	---	i-Propylbenzene
---	c-4-Methyl-2-pentene	---	n-Propylbenzene
---	3-Methylpentane	---	p-Ethyltoluene
---	1-Hexene	---	m-Ethyltoluene
0.5	n-Hexane	---	o-Ethyltoluene
---	t-2-Hexene	---	1,3,5-Trimethylbenzene
---	c-2-Hexene	2.0	1,2,4-Trimethylbenzene
---	Methylcyclopentane	---	1,2,3-Trimethylbenzene
---	2,4-Dimethylpentane	---	Methylstyrene
0.5	Benzene	---	1,3-Diethylbenzene
---	Cyclohexane	---	1,4-Diethylbenzene

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	1.0	4
Σ Aromatic	5.5	22
Σ Paraffin	17.5	72
Acetylene	0.5	2
	24.5	

---

* missing value

TABLE C59. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 5 MILES FROM REFINERY AT 2000 FT. 7-8-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
2.5	Ethane	3.5	2,3-Dimethylpentane
*	Ethylene	0.5	3-Methylhexane
14.0	Acetylene	5.0	2,2,3-Trimethylpentane
1.5	Propane	0.5	n-Heptane
1.5	Propene	0.5	Methylcyclohexane
5.0	i-Butane	1.5	2,4-Dimethylhexane
0.5	n-Butane	2.0	2,3,4-Trimethylpentane
0.5	1-Butene	4.0	Toluene
---	i-Butene	3.0	2,3-Dimethylhexane
---	t-2-Butene	1.0	2-Methylheptane
8.0	c-2-Butene	0.5	3-Ethylhexane
3.0	i-Pentane	0.5	n-Octane
---	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	2.5	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	3.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
1.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
0.5	3-Methylpentane	2.0	m-Ethyltoluene
---	1-Hexene	1.5	o-Ethyltoluene
1.0	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	3.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
1.5	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
1.0	Benzene	0.5	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.5	4
Σ Aromatic	26	30
Σ Paraffin	57.5	66
Acetylene	---	-
	87	

* missing value

TABLE C60. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED IN DOWNTOWN AREA AT TERRE HUATE, INDIANA ON 7-8-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
5.5	Ethane	19.0	2,3-Dimethylpentane
12.0	Ethylene	7.5	3-Methylhexane
4.0	Acetylene	13.0	2,2,3-Trimethylpentane
19.5	Propane	8.5	n-Heptane
4.5	Propene	5.0	Methylcyclohexane
20.0	i-Butane	4.0	2,4-Dimethylhexane
93.5	n-Butane	4.0	2,3,4-Trimethylpentane
24.5	1-Butene	39.0	Toluene
9.5	i-Butene	2.5	2,3-Dimethylhexane
3.5	t-2-Butene	4.0	2-Methylheptane
9.0	c-2-Butene	4.0	3-Ethylhexane
12.0	i-Pentane	2.0	n-Octane
18.0	n-Pentane	---	Ethylcyclohexane
6.0	1-Pentene	6.0	Ethylbenzene
---	t-2-Pentene	18.5	p & m-Xylene
22.0	c-2-Pentene	3.0	Styrene
---	Cyclopentene	6.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
27.5	2-Methylpentane	2.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	3.5	p-Ethyltoluene
16.0	3-Methylpentane	2.0	m-Ethyltoluene
---	1-Hexene	11.0	o-Ethyltoluene
15.0	n-Hexane	2.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	8.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
13.0	Methylcyclopentane	---	Methylstyrene
7.0	2,4-Dimethylpentane	1.5	1,3-Diethylbenzene
14.0	Benzene	1.0	1,4-Diethylbenzene
3.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	81.0	15
Σ Aromatic	119	23
Σ Paraffin	324	61
Acetylene	4.0	1
	528	

TABLE C61. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED ON MAIN STREET IN TERRE HUATE, INDIANA ON 7-8-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
6.0	Ethane	84.0	2,3-Dimethylpentane
22.0	Ethylene	40.5	3-Methylhexane
53.0	Acetylene	42.0	2,2,3-Trimethylpentane
25.5	Propane	57.0	n-Heptane
28.0	Propene	30.5	Methylcyclohexane
34.5	i-Butane	18.0	2,4-Dimethylhexane
160	n-Butane	13.0	2,3,4-Trimethylpentane
0.5	1-Butene	186	Toluene
7.0	i-Butene	10.5	2,3-Dimethylhexane
10.0	t-2-Butene	30.0	2-Methylheptane
15.5	c-2-Butene	27.5	3-Ethylhexane
167	i-Pentane	23.5	n-Octane
90.0	n-Pentane	---	Ethylcyclohexane
9.0	1-Pentene	38.5	Ethylbenzene
---	t-2-Pentene	135.5	p & m-Xylene
6.0	c-2-Pentene	23.5	Styrene
---	Cyclopentene	53.9	o-Xylene
---	Cyclopentane	8.5	n-Nonane
---	2,3-Dimethylbutane	3.0	i-Propylbenzene
83.5	2-Methylpentane	17.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	39.5	p-Ethyltoluene
58.0	3-Methylpentane	20.0	m-Ethyltoluene
---	1-Hexene	31.0	o-Ethyltoluene
66.0	n-Hexane	23.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	69.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
57.5	Methylcyclopentane	---	Methylstyrene
23.5	2,4-Dimethylpentane	12.0	1,3-Diethylbenzene
59.5	Benzene	5.0	1,4-Diethylbenzene
18.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	98.0	5
Σ Aromatic	716	39
Σ Paraffin	949	52
Acetylene	53.0	3
	1816	

TABLE C62. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE
1 MILE FROM REFINERY AT 1500 FT. ON 7-9-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
78.5	Ethane	5.0	2,3-Dimethylpentane
36.0	Ethylene	2.5	3-Methylhexane
7.5	Acetylene	2.5	2,2,3-Trimethylpentane
128	Propane	4.0	n-Heptane
9.5	Propene	3.0	Methylcyclohexane
23.5	i-Butane	0.5	2,4-Dimethylhexane
39.0	n-Butane	0.5	2,3,4-Trimethylpentane
4.0	1-Butene	10.0	Toluene
2.5	i-Butene	1.0	2,3-Dimethylhexane
2.0	t-2-Butene	2.0	2-Methylheptane
1.5	c-2-Butene	1.5	3-Ethylhexane
28.0	i-Pentane	2.0	n-Octane
24.0	n-Pentane	---	Ethylcyclohexane
*	1-Pentene	2.0	Ethylbenzene
*	t-2-Pentene	5.0	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	2.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
7.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
5.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
6.5	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
4.0	Methylcyclopentane	---	Methylstyrene
1.5	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
3.0	Benzene	---	1,4-Diethylbenzene
1.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	33.5	8
Σ Aromatic	29	6
Σ Paraffin	375	84
Acetylene	7.5	2
	445	

TABLE C63. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 5 MILES FROM REFINERY AT 1500 FT. ON 7-9-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
15.0	**Ethane**	4.0	**2,3-Dimethylpentane**
*	**Ethylene**	2.0	**3-Methylhexane**
1.0	**Acetylene**	2.5	**2,2,3-Trimethylpentane**
38.0	**Propane**	2.5	**n-Heptane**
4.5	**Propene**	2.0	**Methylcyclohexane**
10.5	**i-Butane**	---	**2,4-Dimethylhexane**
26.0	**n-Butane**	0.5	**2,3,4-Trimethylpentane**
0.5	**1-Butene**	10.0	**Toluene**
1.0	**i-Butene**	0.5	**2,3-Dimethylhexane**
1.0	**t-2-Butene**	1.5	**2-Methylheptane**
000	**c-2-Butene**	1.0	**3-Ethylhexane**
29.5	**i-Pentane**	1.5	**n-Octane**
19.0	**n-Pentane**	---	**Ethylcyclohexane**
1.5	**1-Pentene**	2.0	**Ethylbenzene**
1.0	**t-2-Pentene**	5.0	**p & m-Xylene**
2.0	**c-2-Pentene**	1.5	**Styrene**
---	**Cyclopentene**	2.0	**o-Xylene**
---	**Cyclopentane**	---	**n-Nonane**
---	**2,3-Dimethylbutane**	---	**i-Propylbenzene**
8.0	**2-Methylpentane**	1.0	**n-Propylbenzene**
---	**c-4-Methyl-2-pentene**	1.0	**p-Ethyltoluene**
5.0	**3-Methylpentane**	0.5	**m-Ethyltoluene**
---	**1-Hexene**	1.0	**o-Ethyltoluene**
7.0	**n-Hexane**	0.5	**1,3,5-Trimethylbenzene**
---	**t-2-Hexene**	2.0	**1,2,4-Trimethylbenzene**
---	**c-2-Hexene**	---	**1,2,3-Trimethylbenzene**
4.5	**Methylcyclopentane**	---	**Methylstyrene**
1.5	**2,4-Dimethylpentane**	0.5	**1,3-Diethylbenzene**
3.0	**Benzene**	---	**1,4-Diethylbenzene**
1.5	**Cyclohexane**		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	11.5	5
Σ Aromatic	30.0	13
Σ Paraffin	194	82
Acetylene	1.0	-
	236.5	

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* missing value

TABLE C64. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 10 MILES FROM REFINERY AT 1500 FT. ON 7-9-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.0	Ethane	1.5	2,3-Dimethylpentane
*	Ethylene	1.0	3-Methylhexane
2.0	Acetylene	0.5	2,2,3-Trimethylpentane
17.0	Propane	1.0	n-Heptane
0.5	Propene	1.0	Methylcyclohexane
3.0	i-Butane	---	2,4-Dimethylhexane
12.5	n-Butane	---	2,3,4-Trimethylpentane
1.0	1-Butene	4.0	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	1.0	3-Ethylhexane
8.5	i-Pentane	1.0	n-Octane
4.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	3.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.5	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
1.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
2.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	1.5	2
Σ Aromatic	15.5	18
Σ Paraffin	68.5	78
Acetylene	2.0	2
	87.5	

* missing value

TABLE C65. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 10 MILES FROM REFINERY AT 1500 FT. ON 7-9-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
8.0	Ethane	4.5	2,3-Dimethylpentane
*	Ethylene	1.5	3-Methylhexane
8.0	Acetylene	5.5	2,2,3-Trimethylpentane
36.5	Propane	2.0	n-Heptane
2.0	Propene	2.0	Methylcyclohexane
6.5	i-Butane	1.0	2,4-Dimethylhexane
19.0	n-Butane	2.0	2,3,4-Trimethylpentane
0.5	1-Butene	10.0	Toluene
0.5	i-Butene	1.0	2,3-Dimethylhexane
0.5	t-2-Butene	1.0	2-Methylheptane
---	c-2-Butene	1.0	3-Ethylhexane
20.0	i-Pentane	1.0	n-Octane
9.0	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	1.0	Ethylbenzene
0.5	t-2-Pentene	4.0	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---		---	i-Propylbenzene
0.5	2,3-Dimethylbutane	---	n-Propylbenzene
---	2-Methylpentane	0.5	p-Ethyltoluene
1.5	c-4-Methyl-2-pentene	---	m-Ethyltoluene
---	3-Methylpentane	0.5	o-Ethyltoluene
4.5	1-Hexene	0.5	1,3,5-Trimethylbenzene
	n-Hexane	0.5	1,2,4-Trimethylbenzene
---	t-2-Hexene	---	1,2,3-Trimethylbenzene
---	c-2-Hexene	---	Methylstyrene
3.0	Methylcyclopentane	---	1,3-Diethylbenzene
1.5	2,4-Dimethylpentane	---	1,4-Diethylbenzene
2.0	Benzene		
1.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	9.0	5
Σ Aromatic	20.5	12
Σ Paraffin	134	78
Acetylene	8.0	5
	171.5	

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* missing value

TABLE C66. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-10-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
3.5	Ethane	0.5	2,3-Dimethylpentane
2.5	Ethylene	0.5	3-Methylhexane
2.0	Acetylene	0.5	2,2,3-Trimethylpentane
15.0	Propane	0.5	n-Heptane
1.0	Propene	---	Methylcyclohexane
3.0	i-Butane	---	2,4-Dimethylhexane
14.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
10.0	i-Pentane	---	n-Octane
5.0	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
0.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.0	7
Σ Aromatic	4.5	7
Σ Paraffin	56.0	83
Acetylene	2.0	3
	67	

TABLE C67. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-11-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
8.5	Ethane	0.5	2,3-Dimethylpentane
2.5	Ethylene	0.5	3-Methylhexane
2.0	Acetylene	0.5	2,2,3-Trimethylpentane
8.0	Propane	0.5	n-Heptane
1.5	Propene	0.5	Methylcyclohexane
3.0	i-Butane	---	2,4-Dimethylhexane
10.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
4.0	i-Pentane	0.5	n-Octane
4.0	n-Pentane	0.5	Ethylcyclohexane
0.5	1-Pentene	0.2	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.2	Styrene
---	Cyclopentene	0.2	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.5	9
Σ Aromatic	3.0	5
Σ Paraffin	48.5	82
Acetylene	2.0	3
	59	

TABLE C68, INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 15 MILES FROM REFINERY AT 1000 FT. ON 7-11-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
6.5	Ethane	*	2,3-Dimethylpentane
*	Ethylene	*	3-Methylhexane
6.0	Acetylene	*	2,2,3-Trimethylpentane
23.5	Propane	*	n-Heptane
3.0	Propene	*	Methylcyclohexane
2.5	i-Butane	*	2,4-Dimethylhexane
10.0	n-Butane	*	2,3,4-Trimethylpentane
0.5	1-Butene	*	Toluene
0.5	i-Butene	*	2,3-Dimethylhexane
---	t-2-Butene	*	2-Methylheptane
---	c-2-Butene	*	3-Ethylhexane
51.0	i-Pentane	*	n-Octane
16.0	n-Pentane	*	Ethylcyclohexane
0.5	1-Pentene	*	Ethylbenzene
---	t-2-Pentene	*	p & m-Xylene
0.5	c-2-Pentene	*	Styrene
---	Cyclopentene	*	o-Xylene
---	Cyclopentane	*	n-Nonane
---	2,3-Dimethylbutane	*	i-Propylbenzene
11.5	2-Methylpentane	*	n-Propylbenzene
---	c-4-Methyl-2-pentene	*	p-Ethyltoluene
4.5	3-Methylpentane	*	m-Ethyltoluene
---	1-Hexene	*	o-Ethyltoluene
6.5	n-Hexane	*	1,3,5-Trimethylbenzene
---	t-2-Hexene	*	1,2,4-Trimethylbenzene
---	c-2-Hexene	*	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	*	Methylstyrene
16.5	2,4-Dimethylpentane	*	1,3-Diethylbenzene
2.5	Benzene	*	1,4-Diethylbenzene
1.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	*	*
Σ Aromatic	*	*
Σ Paraffin	*	*
Acetylene	6.0	*

* missing value

TABLE C69. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 14000 FT. OVER ROBINSON ON 7-11-77

ug/m^3	**Hydrocarbon**	ug/m^3	**Hydrocarbon**
3.0	**Ethane**	---	**2,3-Dimethylpentane**
0.5	**Ethylene**	---	**3-Methylhexane**
---	**Acetylene**	*	**2,2,3-Trimethylpentane**
1.0	**Propane**	---	**n-Heptane**
0.5	**Propene**	---	**Methylcyclohexane**
0.5	**i-Butane**	*	**2,4-Dimethylhexane**
1.0	**n-Butane**	*	**2,3,4-Trimethylpentane**
---	**1-Butene**	*	**Toluene**
---	**i-Butene**	*	**2,3-Dimethylhexane**
---	**t-2-Butene**	*	**2-Methylheptane**
---	**c-2-Butene**	---	**3-Ethylhexane**
0.5	**i-Pentane**	---	**n-Octane**
0.5	**n-Pentane**	---	**Ethylcyclohexane**
---	**1-Pentene**	*	**Ethylbenzene**
---	**t-2-Pentene**	*	**p & m-Xylene**
---	**c-2-Pentene**	*	**Styrene**
---	**Cyclopentene**	*	**o-Xylene**
---	**Cyclopentane**	---	**n-Nonane**
---	**2,3-Dimethylbutane**	---	**i-Propylbenzene**
---	**2-Methylpentane**	---	**n-Propylbenzene**
---	**c-4-Methyl-2-pentene**	---	**p-Ethyltoluene**
---	**3-Methylpentane**	---	**m-Ethyltoluene**
---	**1-Hexene**	---	**o-Ethyltoluene**
---	**n-Hexane**	---	**1,3,5-Trimethylbenzene**
---	**t-2-Hexene**	---	**1,2,4-Trimethylbenzene**
---	**c-2-Hexene**	---	**1,2,3-Trimethylbenzene**
---	**Methylcyclopentane**	---	**Methylstyrene**
---	**2,4-Dimethylpentane**	---	**1,3-Diethylbenzene**
---	**Benzene**	---	**1,4-Diethylbenzene**
---	**Cyclohexane**		

Total Identified Hydrocarbons	ug/m^3	**%**
Σ Olefin	*	*
Σ Aromatic	*	*
Σ Paraffin	*	*
Acetylene	---	*

---

* missing value

TABLE C70. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE AT 13,000 TO 14,000 FT. OVER ROBINSON ON 7-12-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
2.0	Ethane	---	2,3-Dimethylpentane
0.5	Ethylene	---	3-Methylhexane
0.5	Acetylene	*	2,2,3-Trimethylpentane
1.0	Propane	---	n-Heptane
0.5	Propene	---	Methylcyclohexane
---	i-Butane	---	2,4-Dimethylhexane
1.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	*	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	*	2-Methylheptane
---	c-2-Butene	*	3-Ethylhexane
---	i-Pentane	---	n-Octane
---	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	*	Ethylbenzene
---	t-2-Pentene	*	p & m-Xylene
---	c-2-Pentene	*	Styrene
---	Cyclopentene	*	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
---	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
---	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
---	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
---	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
---	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	*	*
Σ Aromatic	*	*
Σ Paraffin	*	*
Acetylene	0.5	*

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* missing value

TABLE C71. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 5 MILES FROM REFINERY AT 1000 FT. ON 7-12-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.0	**Ethane**	1.5	**2,3-Dimethylpentane**
*	**Ethylene**	0.5	**3-Methylhexane**
0.5	**Acetylene**	2.5	**2,2,3-Trimethylpentane**
11.0	**Propane**	4.5	**n-Heptane**
1.0	**Propene**	2.5	**Methylcyclohexane**
3.0	**i-Butane**	0.5	**2,4-Dimethylhexane**
9.0	**n-Butane**	0.5	**2,3,4-Trimethylpentane**
0.5	**1-Butene**	*	**Toluene**
0.5	**i-Butene**	1.5	**2,3-Dimethylhexane**
---	**t-2-Butene**	1.0	**2-Methylheptane**
---	**c-2-Butene**	0.5	**3-Ethylhexane**
5.5	**i-Pentane**	2.0	**n-Octane**
3.0	**n-Pentane**	---	**Ethylcyclohexane**
0.5	**1-Pentene**	*	**Ethylbenzene**
---	**t-2-Pentene**	*	**p & m-Xylene**
---	**c-2-Pentene**	*	**Styrene**
---	**Cyclopentene**	*	**o-Xylene**
---	**Cyclopentane**	---	**n-Nonane**
---	**2,3-Dimethylbutane**	---	**i-Propylbenzene**
1.5	**2-Methylpentane**	*	**n-Propylbenzene**
---	**c-4-Methyl-2-pentene**	*	**p-Ethyltoluene**
2.0	**3-Methylpentane**	*	**m-Ethyltoluene**
---	**1-Hexene**	*	**o-Ethyltoluene**
9.0	**n-Hexane**	*	**1,3,5-Trimethylbenzene**
---	**t-2-Hexene**	*	**1,2,4-Trimethylbenzene**
---	**c-2-Hexene**	---	**1,2,3-Trimethylbenzene**
1.5	**Methylcyclopentane**	---	**Methylstyrene**
1.0	**2,4-Dimethylpentane**	*	**1,3-Diethylbenzene**
2.5	**Benzene**	*	**1,4-Diethylbenzene**
0.5	**Cyclohexane**		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	*	*
Σ Aromatic	*	*
Σ Paraffin	*	*
Acetylene	0.5	*

* missing value

TABLE C72. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 5 MILES FROM THE REFINERY AT 2000 FT. ON 7-12-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
8.0	Ethane	1.0	2,3-Dimethylpentane
0.5	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	0.5	2,2,3-Trimethylpentane
10.0	Propane	0.5	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
3.5	i-Butane	---	2,4-Dimethylhexane
9.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	3.0	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
5.0	i-Pentane	0.5	n-Octane
3.0	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
2.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	0.5	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.4	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.0	3
Σ Aromatic	8.5	14
Σ Paraffin	50.0	82
Acetylene	0.5	1
	61	

TABLE C73. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 5 MILES FROM REFINERY AT 500 FT. ON 7-12-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.0	Ethane	1.0	2,3-Dimethylpentane
*	Ethylene	0.5	3-Methylhexane
3.5	Acetylene	1.0	2,2,3-Trimethylpentane
9.0	Propane	0.5	n-Heptane
1.0	Propene	1.0	Methylcyclohexane
2.5	i-Butane	---	2,4-Dimethylhexane
8.5	n-Butane	---	2,3,4-Trimethylpentane
---	1-Butene	2.0	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
4.5	i-Pentane	1.0	n-Octane
2.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	1.0	2
Σ Aromatic	9.0	15
Σ Paraffin	45.5	77
Acetylene	3.5	6
	59	

* missing value

TABLE C74. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 5 MILES FROM REFINERY AT 1500 FT. on 7-12-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
6.5	Ethane	1.0	2,3-Dimethylpentane
*	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	1.0	2,2,3-Trimethylpentane
8.0	Propane	2.0	n-Heptane
0.5	Propene	1.0	Methylcyclohexane
2.5	i-Butane	1.0	2,4-Dimethylhexane
8.0	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
4.0	i-Pentane	1.0	n-Octane
3.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
1.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
2.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.5	Benzene	---	1,4-Diethylbenzene
1.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	1.5	2
Σ Aromatic	9.5	10
Σ Paraffin	80.5	87
Acetylene	0.5	1
	92	

* missing value

TABLE C75. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-13-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
1.0	Ethane	0.5	2,3-Dimethylpentane
0.5	Ethylene	---	3-Methylhexane
---	Acetylene	0.5	2,2,3-Trimethylpentane
5.0	Propane	0.5	n-Heptane
0.5	Propene	---	Methylcyclohexane
1.5	i-Butane	---	2,4-Dimethylhexane
5.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	2.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
2.5	i-Pentane	---	n-Octane
2.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
0.5	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
0.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	8
Σ Aromatic	7.0	23
Σ Paraffin	21.5	69
Acetylene	---	-
	31	

TABLE C76. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-14-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
8.5	Ethane	1.5	2,3-Dimethylpentane
*	Ethylene	1.0	3-Methylhexane
1.5	Acetylene	1.0	2,2,3-Trimethylpentane
20.0	Propane	1.0	n-Heptane
1.0	Propene	1.0	Methylcyclohexane
4.5	i-Butane	---	2,4-Dimethylhexane
16.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	3.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
10.0	i-Pentane	0.5	n-Octane
6.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
3.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
2.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
2.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
2.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
1.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.0	2
Σ Aromatic	10.0	9
Σ Paraffin	93.5	87
Acetylene	1.5	1
	107	

* missing value

TABLE C77. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-14-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
12.0	Ethane	6.5	2,3-Dimethylpentane
3.5	Ethylene	1.5	3-Methylhexane
1.0	Acetylene	8.0	2,2,3-Trimethylpentane
35.0	Propane	2.5	n-Heptane
2.0	Propene	2.0	Methylcyclohexane
7.5	i-Butane	1.0	2,4-Dimethylhexane
27.0	n-Butane	2.5	2,3,4-Trimethylpentane
0.5	1-Butene	10.0	Toluene
0.5	i-Butene	3.0	2,3-Dimethylhexane
0.5	t-2-Butene	2.5	2-Methylheptane
---	c-2-Butene	2.0	3-Ethylhexane
20.0	i-Pentane	2.0	n-Octane
11.0	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	1.5	Ethylbenzene
0.5	t-2-Pentene	4.0	p & m-Xylene
1.5	c-2-Pentene	1.0	Styrene
---	Cyclopentene	3.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
6.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
3.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	2.0	o-Ethyltoluene
4.5	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
3.0	Methylcyclopentane	---	Methylstyrene
2.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
2.0	Benzene	1.0	1,4-Diethylbenzene
1.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	10.0	5
Σ Aromatic	30.0	14
Σ Paraffin	167	80
Acetylene	1.0	1
	208	

TABLE C78. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-14-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
5.5	Ethane	3.0	2,3-Dimethylpentane
1.0	Ethylene	1.5	3-Methylhexane
4.5	Acetylene	1.5	2,2,3-Trimethylpentane
28.0	Propane	2.0	n-Heptane
2.5	Propene	2.0	Methylcyclohexane
6.5	i-Butane	0.5	2,4-Dimethylhexane
23.0	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	7.0	Toluene
0.5	i-Butene	2.0	2,3-Dimethylhexane
---	t-2-Butene	1.5	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
14.0	i-Pentane	2.0	n-Octane
9.5	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	2.0	Ethylbenzene
---	t-2-Pentene	2.5	p & m-Xylene
1.0	c-2-Pentene	1.0	Styrene
---	Cyclopentene	4.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	1.0	i-Propylbenzene
4.5	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
2.5	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
4.0	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
2.5	Methylcyclopentane	---	Methylstyrene
1.0	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
2.0	Benzene	0.5	1,4-Diethylbenzene
1.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	6.0	4
Σ Aromatic	26.5	17
Σ Paraffin	119	76
Acetylene	4.5	3
	156	

TABLE C79. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER ON 7-14-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
5.5	Ethane	3.0	2,3-Dimethylpentane
6.0	Ethylene	1.5	3-Methylhexane
2.0	Acetylene	1.0	2,2,3-Trimethylpentane
30.5	Propane	1.5	n-Heptane
3.5	Propene	1.0	Methylcyclohexane
8.5	i-Butane	0.5	2,4-Dimethylhexane
40.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	4.0	Toluene
1.0	i-Butene	0.5	2,3-Dimethylhexane
1.0	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
29.5	i-Pentane	0.5	n-Octane
13.5	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	0.5	Ethylbenzene
0.5	t-2-Pentene	1.0	p & m-Xylene
1.5	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
10.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
5.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
6.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
4.5	Methylcyclopentane	---	Methylstyrene
1.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
3.0	Benzene	---	1,4-Diethylbenzene
1.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	11.0	6
Σ Aromatic	11.5	6
Σ Paraffin	166	87
Acetylene	2.0	1
	190	

TABLE C80. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-15-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
11.0	Ethane	2.0	2,3-Dimethylpentane
*	Ethylene	1.0	3-Methylhexane
3.5	Acetylene	1.0	2,2,3-Trimethylpentane
18.0	Propane	1.5	n-Heptane
2.0	Propene	1.5	Methylcyclohexane
5.0	i-Butane	0.5	2,4-Dimethylhexane
16.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	6.0	Toluene
0.5	i-Butene	0.5	2,3-Dimethylhexane
1.0	t-2-Butene	1.0	2-Methylheptane
0.5	c-2-Butene	1.0	3-Ethylhexane
9.0	i-Pentane	1.0	n-Octane
6.5	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	1.5	Ethylbenzene
---	t-2-Pentene	4.5	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
3.0	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
2.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
3.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
2.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
3.0	Benzene	---	1,4-Diethylbenzene
1.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.0	4
Σ Aromatic	22.5	18
Σ Paraffin	91.0	75
Acetylene	3.5	3
	122	

* missing value

TABLE C81. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-15-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
69.0	Ethane	24.5	2,3-Dimethylpentane
11.5	Ethylene	13.0	3-Methylhexane
2.0	Acetylene	11.5	2,2,3-Trimethylpentane
896	Propane	19.5	n-Heptane
6.0	Propene	18.0	Methylcyclohexane
49.0	i-Butane	5.0	2,4-Dimethylhexane
160	n-Butane	2.5	2,3,4-Trimethylpentane
0.5	1-Butene	80.0	Toluene
3.0	i-Butene	15.0	2,3-Dimethylhexane
3.0	t-2-Butene	17.5	2-Methylheptane
1.5	c-2-Butene	13.5	3-Ethylhexane
164	i-Pentane	14.0	n-Octane
78.0	n-Pentane	---	Ethylcyclohexane
2.0	1-Pentene	9.0	Ethylbenzene
2.0	t-2-Pentene	18.5	p & m-Xylene
8.0	c-2-Pentene	5.0	Styrene
---	Cyclopentene	7.5	o-Xylene
---	Cyclopentane	3.0	n-Nonane
---	2,3-Dimethylbutane	1.0	i-Propylbenzene
44.0	2-Methylpentane	2.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	4.0	p-Ethyltoluene
25.0	3-Methylpentane	2.0	m-Ethyltoluene
---	1-Hexene	6.0	o-Ethyltoluene
33.0	n-Hexane	4.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	6.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
25.5	Methylcyclopentane	---	Methylstyrene
7.0	2,4-Dimethylpentane	1.5	1,3-Diethylbenzene
10.0	Benzene	2.0	1,4-Diethylbenzene
10.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	31.0	2
Σ Aromatic	159	8
Σ Paraffin	1716	90
Acetylene	2.0	-
	1908	

TABLE C82. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER ON 7-15-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.5	Ethane	2.0	2,3-Dimethylpentane
*	Ethylene	1.0	3-Methylhexane
1.0	Acetylene	1.0	2,2,3-Trimethylpentane
15.0	Propane	1.0	n-Heptane
0.5	Propene	1.0	Methylcyclohexane
3.5	i-Butane	---	2,4-Dimethylhexane
12.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	4.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
0.5	t-2-Butene	0.5	2-Methylheptane
0.5	c-2-Butene	0.5	3-Ethylhexane
8.0	i-Pentane	0.5	n-Octane
4.0	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1:0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
4.0	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
2.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
2.0	n-Hexane	1.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
2.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.0	4
Σ Aromatic	14.0	16
Σ Paraffin	69.0	79
Acetylene	1.0	1
	87	

* missing value

TABLE C83. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVLE SAMPLE COLLECTED AT WSU TRAILER ON 7-18-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
5.0	Ethane	1.0	2,3-Dimethylpentane
1.0	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	0.5	2,2,3-Trimethylpentane
7.0	Propane	0.5	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
1.0	i-Butane	---	2,4-Dimethylhexane
6.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
0.5	c-2-Butene	0.5	3-Ethylhexane
3.5	i-Pentane	---	n-Octane
2.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
2.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
1.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	6
Σ Aromatic	7.0	16
Σ Paraffin	34.5	78
Acetylene	0.5	1
	44	

TABLE C84. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER ON 7-18-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
12.0	Ethane		
5.0	Ethylene	2.5	2,3-Dimethylpentane
1.0	Acetylene	1.0	3-Methylhexane
34.0	Propane	1.0	2,2,3-Trimethylpentane
3.5	Propene	1.5	n-Heptane
9.0	i-Butane	1.5	Methylcyclohexane
29.0	n-Butane	0.5	2,4-Dimethylhexane
0.5	1-Butene	0.5	2,3,4-Trimethylpentane
0.5	i-Butene	7.5	Toluene
---	t-2-Butene	0.5	2,3-Dimethylhexane
0.5	c-2-Butene	1.0	2-Methylheptane
17.5	i-Pentane	0.5	3-Ethylhexane
11.5	n-Pentane	6.0	n-Octane
1.0	1-Pentene	---	Ethylcyclohexane
---	t-2-Pentene	1.0	Ethylbenzene
0.5	c-2-Pentene	2.5	p & m-Xylene
---	Cyclopentene	0.5	Styrene
---	Cyclopentane	0.5	o-Xylene
---	2,3-Dimethylbutane	---	n-Nonane
5.0	2-Methylpentane	---	i-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	n-Propylbenzene
3.0	3-Methylpentane	0.5	p-Ethyltoluene
---	1-Hexene	---	m-Ethyltoluene
4.5	n-Hexane	0.5	o-Ethyltoluene
---	t-2-Hexene	0.5	1,3,5-Trimethylbenzene
---	c-2-Hexene	1.0	1,2,4-Trimethylbenzene
3.5	Methylcyclopentane	---	1,2,3-Trimethylbenzene
1.0	2,4-Dimethylpentane	---	Methylstyrene
2.5	Benzene	---	1,3-Diethylbenzene
1.5	Cyclohexane	0.5	1,4-Diethylbenzene

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	9.5	5
Σ Aromatic	19.0	11
Σ Paraffin	148	84
Acetylene	1.0	-
	177	

TABLE C85. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED 1.5 MILES DOWNWIND OF REFINERY ON 7-18-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
19.0	Ethane	311	2,3-Dimethylpentane
3.0	Ethylene	149	3-Methylhexane
1.5	Acetylene	93.5	2,2,3-Trimethylpentane
96.0	Propane	138	n-Heptane
6.0	Propene	127	Methylcyclohexane
81.5	i-Butane	14.5	2,4-Dimethylhexane
371	n-Butane	16.0	2,3,4-Trimethylpentane
0.5	1-Butene	63.0	Toluene
3.5	i-Butene	11.5	2,3-Dimethylhexane
2.5	t-2-Butene	51.0	2-Methylheptane
1.0	c-2-Butene	42.5	3-Ethylhexane
529	i-Pentane	48.5	n-Octane
199	n-Pentane	---	Ethylcyclohexane
34.0	1-Pentene	18.5	Ethylbenzene
5.0	t-2-Pentene	35.0	p & m-Xylene
6.0	c-2-Pentene	9.0	Styrene
---	Cyclopentene	12.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	4.5	i-Propylbenzene
716	2-Methylpentane	3.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	4.5	p-Ethyltoluene
457	3-Methylpentane	2.0	m-Ethyltoluene
---	1-Hexene	5.0	o-Ethyltoluene
265	n-Hexane	4.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	5.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
600	Methylcyclopentane	---	Methylstyrene
121	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
120	Benzene	1.0	1,4-Diethylbenzene
118	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	61.5	1
Σ Aromatic	288	6
Σ Paraffin	4573	93
Acetylene	1.5	-
	4924	

TABLE C86. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED DOWNWIND OF THE REFINERY AT FENCELINE ON 7-18-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
23.0	Ethane	14.0	2,3-Dimethylpentane
14.0	Ethylene	8.0	3-Methylhexane
3.0	Acetylene	5.5	2,2,3-Trimethylpentane
150	Propane	9.0	n-Heptane
3.5	Propene	7.5	Methylcyclohexane
47.0	i-Butane	2.0	2,4-Dimethylhexane
243	n-Butane	1.0	2,3,4-Trimethylpentane
0.5	1-Butene	28.0	Toluene
2.0	i-Butene	1.5	2,3-Dimethylhexane
1.5	t-2-Butene	4.5	2-Methylheptane
0.5	c-2-Butene	4.0	3-Ethylhexane
148	i-Pentane	4.5	n-Octane
69.5	n-Pentane	---	Ethylcyclohexane
6.0	1-Pentene	4.0	Ethylbenzene
1.0	t-2-Pentene	9.0	p & m-Xylene
34.0	c-2-Pentene	2.0	Styrene
---	Cyclopentene	3.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	1.0	i-Propylbenzene
36.5	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	2.0	p-Ethyltoluene
21.0	3-Methylpentane	1.0	m-Ethyltoluene
---	1-Hexene	2.0	o-Ethyltoluene
25.5	n-Hexane	2.0	1,3,5-Trimethylbenzene
---	t-2-Hexene	3.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
18.0	Methylcyclopentane	---	Methylstyrene
4.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
9.0	Benzene	0.5	1,4-Diethylbenzene
6.5	Cyclohexane		

Total Identified Hydrocarbons	μg/m^3	%
Σ Olefin	53.0	5
Σ Aromatic	69.0	7
Σ Paraffin	854.0	88
Acetylene	3.0	-
	979	

TABLE C87. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED 10 MILES FROM THE REFINERY AT 1500 FT. ON 7-19-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
5.0	**Ethane**	1.0	**2,3-Dimethylpentane**
1.0	**Ethylene**	0.5	**3-Methylhexane**
1.0	**Acetylene**	3.0	**2,2,3-Trimethylpentane**
7.0	**Propane**	0.5	**n-Heptane**
1.0	**Propene**	0.5	**Methylcyclohexane**
2.5	**i-Butane**	0.5	**2,4-Dimethylhexane**
7.5	**n-Butane**	0.5	**2,3,4-Trimethylpentane**
1.0	**1-Butene**	1.5	**Toluene**
0.5	**i-Butene**	1.0	**2,3-Dimethylhexane**
---	**t-2-Butene**	0.5	**2-Methylheptane**
---	**c-2-Butene**	1.0	**3-Ethylhexane**
3.5	**i-Pentane**	0.5	**n-Octane**
2.5	**n-Pentane**	---	**Ethylcyclohexane**
---	**1-Pentene**	1.0	**Ethylbenzene**
---	**t-2-Pentene**	1.5	**p & m-Xylene**
---	**c-2-Pentene**	1.5	**Styrene**
---	**Cyclopentene**	1.0	**o-Xylene**
---	**Cyclopentane**	---	**n-Nonane**
---	**2,3-Dimethylbutane**	---	**i-Propylbenzene**
1.0	**2-Methylpentane**	2.5	**n-Propylbenzene**
---	**c-4-Methyl-2-pentene**	---	**p-Ethyltoluene**
1.0	**3-Methylpentane**	---	**m-Ethyltoluene**
---	**1-Hexene**	0.5	**o-Ethyltoluene**
1.5	**n-Hexane**	---	**1,3,5-Trimethylbenzene**
---	**t-2-Hexene**	1.5	**1,2,4-Trimethylbenzene**
---	**c-2-Hexene**	---	**1,2,3-Trimethylbenzene**
0.5	**Methylcyclopentane**	---	**Methylstyrene**
0.5	**2,4-Dimethylpentane**	---	**1,3-Diethylbenzene**
1.0	**Benzene**	---	**1,4-Diethylbenzene**
0.5	**Cyclohexane**		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.5	6
Σ Aromatic	12.0	20
Σ Paraffin	42.5	72
Acetylene	1.0	2
	59	

TABLE C88. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECETED 15 MILES FROM THE REFINERY AT 1500 FT. 7-19-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
5.0	Ethane	1.0	2,3-Dimethylpentane
*	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	0.5	2,2,3-Trimethylpentane
7.0	Propane	0.5	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
2.5	i-Butane	---	2,4-Dimethylhexane
7.0	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
0.5	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
3.5	i-Pentane	0.5	n-Octane
3.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	1.5	3
Σ Aromatic	6.0	13
Σ Paraffin	38.5	83
Acetylene	0.5	1
	46.5	

* missing value

TABLE C89. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED 13,500 FT. OVER ROBINSON ON 7-19-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
1.0	Ethane	0.5	2,3-Dimethylpentane
1.0	Ethylene	---	3-Methylhexane
1.0	Acetylene	*	2,2,3-Trimethylpentane
1.0	Propane	---	n-Heptane
0.5	Propene	---	Methylcyclohexane
---	i-Butane	*	2,4-Dimethylhexane
1.0	n-Butane	*	2,3,4-Trimethylpentane
---	1-Butene	*	Toluene
0.5	i-Butene	*	2,3-Dimethylhexane
---	t-2-Butene	*	2-Methylheptane
---	c-2-Butene	*	3-Ethylhexane
---	i-Pentane	---	n-Octane
0.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	*	Ethylbenzene
---	t-2-Pentene	*	p & m-Xylene
---	c-2-Pentene	*	Styrene
---	Cyclopentene	*	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
---	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
---	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
0.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
---	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
---	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	*	*
Σ Aromatic	*	*
Σ Paraffin	*	*
Acetylene	1.0	*

* missing value

TABLE C90. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT COLLECTED SAMPLE 8000 FT. OVER ROBINSON ON 7-19-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
1.0	Ethane	0.5	2,3-Dimethylpentane
1.0	Ethylene	---	3-Methylhexane
0.5	Acetylene	*	2,2,3-Trimethylpentane
1.5	Propane	---	n-Heptane
0.5	Propene	---	Methylcyclohexane
---	i-Butane	*	2,4-Dimethylhexane
1.0	n-Butane	*	2,3,4-Trimethylpentane
0.5	1-Butene	*	Toluene
---	i-Butene	*	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	*	3-Ethylhexane
---	i-Pentane	---	n-Octane
---	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	*	Ethylbenzene
---	t-2-Pentene	*	p & m-Xylene
---	c-2-Pentene	*	Styrene
---	Cyclopentene	*	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
---	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
---	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
---	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
---	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	*	*
Σ Aromatic	*	*
Σ Paraffin	*	*
Acetylene	0.5	*

* missing value

TABLE C91. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED AT 1500 FT. OVER ROBINSON ON 7-19-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
1.5	Ethane	---	2,3-Dimethylpentane
*	Ethylene	---	3-Methylhexane
1.0	Acetylene	0.5	2,2,3-Trimethylpentane
2.0	Propane	---	n-Heptane
0.5	Propene	---	Methylcyclohexane
0.5	i-Butane	---	2,4-Dimethylhexane
1.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	*	Toluene
---	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
1.0	i-Pentane	---	n-Octane
---	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	*	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
---	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
---	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
---	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	1.0	7
Σ Aromatic	2.5	17
Σ Paraffin	10.0	69
Acetylene	1.0	7
	14.5	

---

* missing value

TABLE C92. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED 3 MILES FROM THE REFINERY AT 1500 FT. ON 7-19-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
3.5	Ethane	0.5	2,3-Dimethylpentane
0.5	Ethylene	---	3-Methylhexane
1.0	Acetylene	1.0	2,2,3-Trimethylpentane
5.0	Propane	0.5	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
1.0	i-Butane	0.5	2,4-Dimethylhexane
4.0	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
---	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
2.5	i-Pentane	0.5	n-Octane
2.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	2.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
0.5	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
0.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	2.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	1.5	4
Σ Aromatic	10.0	26
Σ Paraffin	25.5	67
Acetylene	1.0	3
	38	

TABLE C93. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED 13 MILES FROM REFINERY AT 1500 FT. ON 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
9.5	Ethane	2.5	2,3-Dimethylpentane
*	Ethylene	0.5	3-Methylhexane
1.0	Acetylene	1.5	2,2,3-Trimethylpentane
15.0	Propane	1.0	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
3.5	i-Butane	1.0	2,4-Dimethylhexane
10.0	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	2.5	Toluene
0.5	i-Butene	1.5	2,3-Dimethylhexane
---	t-2-Butene	1.0	2-Methylheptane
---	c-2-Butene	1.0	3-Ethylhexane
7.5	i-Pentane	0.5	n-Octane
4.5	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
2.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
2.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
1.0	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.0	2
Σ Aromatic	11.5	14
Σ Paraffin	69.0	83
Acetylene	1.0	1
	83.5	

* missing value

TABLE C94. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED 8 MILES FROM REFINERY AT 1500 FT. 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
8.5	Ethane	*	2,3-Dimethylpentane
*	Ethylene	*	3-Methylhexane
1.0	Acetylene	*	2,2,3-Trimethylpentane
27.0	Propane	*	n-Heptane
2.0	Propene	*	Methylcyclohexane
3.0	i-Butane	*	2,4-Dimethylhexane
9.0	n-Butane	*	2,3,4-Trimethylpentane
0.5	1-Butene	*	Toluene
---	i-Butene	*	2,3-Dimethylhexane
---	t-2-Butene	*	2-Methylheptane
---	c-2-Butene	*	3-Ethylhexane
28.0	i-Pentane	*	n-Octane
4.0	n-Pentane	*	Ethylcyclohexane
0.5	1-Pentene	*	Ethylbenzene
---	t-2-Pentene	*	p & m-Xylene
---	c-2-Pentene	*	Styrene
---	Cyclopentene	*	o-Xylene
---	Cyclopentane	*	n-Nonane
---	2,3-Dimethylbutane	*	i-Propylbenzene
7.0	2-Methylpentane	*	n-Propylbenzene
---	c-4-Methyl-2-pentene	*	p-Ethyltoluene
4.5	3-Methylpentane	*	m-Ethyltoluene
---	1-Hexene	*	o-Ethyltoluene
2.5	n-Hexane	*	1,3,5-Trimethylbenzene
---	t-2-Hexene	*	1,2,4-Trimethylbenzene
---	c-2-Hexene	*	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	*	Methylstyrene
11.0	2,4-Dimethylpentane	*	1,3-Diethylbenzene
1.0	Benzene	*	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin		
Σ Aromatic		
Σ Paraffin		
Acetylene		

* missing value

TABLE C95. INDIVIDUAL HYDROCARBON CONCENTRATION IN AIRCRAFT SAMPLE COLLECTED 5 MILES FROM REFINERY AT 1500 FT. ON 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
9.0	Ethane	2.0	2,3-Dimethylpentane
*	Ethylene	0.5	3-Methylhexane
1.0	Acetylene	1.5	2,2,3-Trimethylpentane
18.0	Propane	1.5	n-Heptane
0.5	Propene	1.0	Methylcyclohexane
4.0	i-Butane	0.5	2,4-Dimethylhexane
13.0	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	4.5	Toluene
0.5	i-Butene	1.5	2,3-Dimethylhexane
0.5	t-2-Butene	1.0	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
9.0	i-Pentane	0.5	n-Octane
5.5	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	2.0	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
2.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.5	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
2.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	2
Σ Aromatic	17.5	18
Σ Paraffin	77.5	79
Acetylene	1.0	1
	98.5	

* missing value

TABLE C96. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED
0-2 MILES FROM REFINERY AT 1000 FT. ON 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
149	Ethane		
17.5	Ethylene	15.5	2,3-Dimethylpentane
1.5	Acetylene	8.0	3-Methylhexane
223	Propane	8.5	2,2,3-Trimethylpentane
44.0	Propene	26.0	n-Heptane
36.0	i-Butane	17.0	Methylcyclohexane
81.5	n-Butane	1.5	2,4-Dimethylhexane
0.5	1-Butene	3.0	2,3,4-Trimethylpentane
16.5	i-Butene	41.5	Toluene
13.0	t-2-Butene	4.5	2,3-Dimethylhexane
10.0	c-2-Butene	10.5	2-Methylheptane
75.0	i-Pentane	6.5	3-Ethylhexane
57.0	n-Pentane	14.0	n-Octane
3.0	1-Pentene	---	Ethylcyclohexane
1.0	t-2-Pentene	6.5	Ethylbenzene
19.5	c-2-Pentene	11.5	p & m-Xylene
---	Cyclopentene	4.0	Styrene
---	Cyclopentane	4.5	o-Xylene
---	2,3-Dimethylbutane	---	n-Nonane
25.0	2-Methylpentane	2.0	i-Propylbenzene
---	c-4-Methyl-2-pentene	1.5	n-Propylbenzene
12.5	3-Methylpentane	2.0	p-Ethyltoluene
---	1-Hexene	0.5	m-Ethyltoluene
33.5	n-Hexane	1.5	o-Ethyltoluene
---	t-2-Hexene	2.0	1,3,5-Trimethylbenzene
---	c-2-Hexene	3.0	1,2,4-Trimethylbenzene
10.0	Methylcyclopentane	---	1,2,3-Trimethylbenzene
4.5	2,4-Dimethylpentane	---	Methylstyrene
10.5	Benzene	0.5	1,3-Diethylbenzene
9.0	Cyclohexane	---	1,4-Diethylbenzene

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	125	12
Σ Aromatic	91.5	9
Σ Paraffin	840	79
Acetylene	1.5	-
	1058	

TABLE C97. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED 5-7 MILES FROM REFINERY AT 1000 FT. ON 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
27.5	Ethane	4.0	2,3-Dimethylpentane
3.5	Ethylene	1.5	3-Methylhexane
1.0	Acetylene	4.0	2,2,3-Trimethylpentane
40.0	Propane	3.5	n-Heptane
3.5	Propene	3.0	Methylcyclohexane
8.5	i-Butane	1.0	2,4-Dimethylhexane
20.0	n-Butane	1.5	2,3,4-Trimethylpentane
0.5	1-Butene	11.0	Toluene
2.5	i-Butene	1.0	2,3-Dimethylhexane
2.0	t-2-Butene	1.5	2-Methylheptane
1.0	c-2-Butene	1.5	3-Ethylhexane
19.5	i-Pentane	1.5	n-Octane
12.0	n-Pentane	---	Ethylcyclohexane
1.0	1-Pentene	1.0	Ethylbenzene
2.0	t-2-Pentene	2.0	p & m-Xylene
2.0	c-2-Pentene	1.0	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
6.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
3.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
6.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
4.5	Methylcyclopentane	---	Methylstyrene
1.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
2.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	18.0	8
Σ Aromatic	20.5	10
Σ Paraffin	175	82
Acetylene	1.0	-
	214	

TABLE C98. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED AT 14,000 FT. OVER ROBINSON ON 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
3.0	Ethane	*	2,3-Dimethylpentane
0.5	Ethylene	---	3-Methylhexane
1.0	Acetylene	*	2,2,3-Trimethylpentane
5.0	Propane	---	n-Heptane
0.5	Propene	---	Methylcyclohexane
0.5	i-Butane	*	2,4-Dimethylhexane
1.5	n-Butane	*	2,3,4-Trimethylpentane
0.5	1-Butene	*	Toluene
---	i-Butene	*	2,3-Dimethylhexane
---	t-2-Butene	*	2-Methylheptane
---	c-2-Butene	*	3-Ethylhexane
2.5	i-Pentane	---	n-Octane
0.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	---	Ethylbenzene
---	t-2-Pentene	*	p & m-Xylene
---	c-2-Pentene	*	Styrene
---	Cyclopentene	*	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
---	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
---	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	*	o-Ethyltoluene
---	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
---	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	*	*
Σ Aromatic	*	*
Σ Paraffin	*	*
Acetylene	1.0	*

* missing value

TABLE C99. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED SW OF ROBINSON AT 3000 FT. ON 7-21-77

ug/m³	Hydrocarbon	ug/m³	Hydrocarbon
5.5	Ethane	*	2,3-Dimethylpentane
1.0	Ethylene	*	3-Methylhexane
1.0	Acetylene	*	2,2,3-Trimethylpentane
6.0	Propane	*	n-Heptane
0.5	Propene	*	Methylcyclohexane
3.0	i-Butane	*	2,4-Dimethylhexane
6.5	n-Butane	*	2,3,4-Trimethylpentane
0.5	1-Butene	*	Toluene
---	i-Butene	*	2,3-Dimethylhexane
---	t-2-Butene	*	2-Methylheptane
---	c-2-Butene	*	3-Ethylhexane
3.0	i-Pentane	*	n-Octane
2.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
2.0	2,4-Dimethylpentane	---	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m³	%
Σ Olefin	*	*
Σ Aromatic	*	*
Σ Paraffin	*	*
Acetylene	1.0	*

* missing value

TABLE C100. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED 12 MILES FROM REFINERY AT 2500 FT. ON 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.5	Ethane	1.0	2,3-Dimethylpentane
1.5	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	1.0	2,2,3-Trimethylpentane
7.0	Propane	1.0	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
2.5	i-Butane	0.5	2,4-Dimethylhexane
6.0	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	3.5	Toluene
---	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	1.0	3-Ethylhexane
3.5	i-Pentane	0.5	n-Octane
2.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	2.0	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
1.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	1.0	o-Ethyltoluene
1.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	4
Σ Aromatic	12.0	20
Σ Paraffin	46.0	75
Acetylene	0.5	1
	61	

TABLE C101. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED 12 MILES FROM REFINERY AT 1500 FT. ON 7-21-77

ug/m³	Hydrocarbon	ug/m³	Hydrocarbon
8.0	Ethane	1.0	2,3-Dimethylpentane
1.0	Ethylene	0.5	3-Methylhexane
0.5	Acetylene	0.5	2,2,3-Trimethylpentane
9.0	Propane	1.0	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
2.5	i-Butane	0.5	2,4-Dimethylhexane
7.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	3.5	Toluene
0.5	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	0.5	3-Ethylhexane
4.5	i-Pentane	0.5	n-Octane
3.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	---	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m³	%
Σ Olefin	4.0	7
Σ Aromatic	6.5	12
Σ Paraffin	44.5	81
Acetylene	0.5	1
	55	

TABLE C102. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN AIRCRAFT SAMPLE COLLECTED APPROXIMATELY 1 MILE UPWIND OF REFINERY AT 1000 FT. ON 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
10.0	Ethane	1.0	2,3-Dimethylpentane
1.0	Ethylene	0.5	3-Methylhexane
1.0	Acetylene	0.5	2,2,3-Trimethylpentane
6.0	Propane	0.5	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
3.0	i-Butane	0.5	2,4-Dimethylhexane
9.5	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	2.0	Toluene
---	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	0.5	2-Methylheptane
---	c-2-Butene	1.0	3-Ethylhexane
3.0	i-Pentane	---	n-Octane
3.5	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	1.0	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.0	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.5	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	---	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	5
Σ Aromatic	6.0	11
Σ Paraffin	44.5	82
Acetylene	1.0	2
	54	

TABLE C103. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT EVANSVILLE, INDIANA ON 7-21-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
7.0	**Ethane**	16.5	**2,3-Dimethylpentane**
*	**Ethylene**	7.0	**3-Methylhexane**
11.0	**Acetylene**	12.0	**2,2,3-Trimethylpentane**
23.5	**Propane**	8.0	**n-Heptane**
8.5	**Propene**	4.5	**Methylcyclohexane**
14.0	**i-Butane**	3.5	**2,4-Dimethylhexane**
52.0	**n-Butane**	4.5	**2,3,4-Trimethylpentane**
0.4	**1-Butene**	34.5	**Toluene**
2.5	**i-Butene**	3.5	**2,3-Dimethylhexane**
3.0	**t-2-Butene**	5.0	**2-Methylheptane**
4.5	**c-2-Butene**	5.0	**3-Ethylhexane**
66.0	**i-Pentane**	2.5	**n-Octane**
30.5	**n-Pentane**	---	**Ethylcyclohexane**
2.5	**1-Pentene**	5.0	**Ethylbenzene**
2.0	**t-2-Pentene**	14.5	**p & m-Xylene**
2.0	**c-2-Pentene**	2.0	**Styrene**
---	**Cyclopentene**	5.5	**o-Xylene**
---	**Cyclopentane**	---	**n-Nonane**
---	**2,3-Dimethylbutane**	0.5	**i-Propylbenzene**
20.5	**2-Methylpentane**	2.0	**n-Propylbenzene**
---	**c-4-Methyl-2-pentene**	3.0	**p-Ethyltoluene**
12.0	**3-Methylpentane**	2.0	**m-Ethyltoluene**
---	**1-Hexene**	3.5	**o-Ethyltoluene**
14.5	**n-Hexane**	2.0	**1,3,5-Trimethylbenzene**
---	**t-2-Hexene**	6.5	**1,2,4-Trimethylbenzene**
---	**c-2-Hexene**	---	**1,2,3-Trimethylbenzene**
11.0	**Methylcyclopentane**	---	**Methylstyrene**
5.5	**2,4-Dimethylpentane**	1.0	**1,3-Diethylbenzene**
11.5	**Benzene**	1.0	**1,4-Diethylbenzene**
3.5	**Cyclohexane**		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	24.5	5
Σ Aromatic	89.0	19
Σ Paraffin	343.5	73
Acetylene	11.0	2
	468	

TABLE C104. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-22-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
2.0	Ethane	---	2,3-Dimethylpentane
*	Ethylene	---	3-Methylhexane
0.5	Acetylene	---	2,2,3-Trimethylpentane
2.0	Propane	---	n-Heptane
0.5	Propene	---	Methylcyclohexane
0.5	i-Butane	---	2,4-Dimethylhexane
2.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	0.5	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
1.0	i-Pentane	---	n-Octane
1.0	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	---	Ethylbenzene
---	t-2-Pentene	---	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
0.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
0.5	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
---	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	1.0	7
Σ Aromatic	3.0	20
Σ Paraffin	10.5	70
Acetylene	0.5	3
	15	

TABLE C105. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-23-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
3.0	Ethane	0.5	2,3-Dimethylpentane
1.0	Ethylene	0.5	3-Methylhexane
1.5	Acetylene	0.5	2,2,3-Trimethylpentane
15.5	Propane	0.5	n-Heptane
2.0	Propene	---	Methylcyclohexane
2.5	i-Butane	---	2,4-Dimethylhexane
12.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.0	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
0.5	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
11.0	i-Pentane	1.5	n-Octane
5.0	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	---	Ethylbenzene
0.5	t-2-Pentene	0.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
4.5	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
2.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
1.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	2.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
---	Methylcyclopentane	---	Methylstyrene
2.5	2,4-Dimethylpentane	0.5	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	5.5	7
Σ Aromatic	8.0	10
Σ Paraffin	63.5	81
Acetylene	1.5	2
	78	

TABLE C106. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-23-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
3.5	Ethane	1.5	2,3-Dimethylpentane
2.0	Ethylene	0.5	3-Methylhexane
1.5	Acetylene	1.0	2,2,3-Trimethylpentane
6.0	Propane	1.5	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
1.5	i-Butane	0.5	2,4-Dimethylhexane
4.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	2.5	Toluene
---	i-Butene	0.5	2,3-Dimethylhexane
---	t-2-Butene	1.0	2-Methylheptane
---	c-2-Butene	1.0	3-Ethylhexane
3.0	i-Pentane	0.5	n-Octane
1.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	1.0	Ethylbenzene
---	t-2-Pentene	2.0	p & m-Xylene
---	c-2-Pentene	3.5	Styrene
---	Cyclopentene	1.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	0.5	i-Propylbenzene
1.0	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	1.0	p-Ethyltoluene
1.0	3-Methylpentane	0.5	m-Ethyltoluene
---	1-Hexene	1.5	o-Ethyltoluene
1.0	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
0.5	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	1.0	1,3-Diethylbenzene
1.5	Benzene	0.5	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	3.0	5
Σ Aromatic	20.5	37
Σ Paraffin	31.5	56
Acetylene	1.5	2
	56	

TABLE C107. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-24-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
6.0	Ethane	1.0	2,3-Dimethylpentane
1.0	Ethylene	0.5	3-Methylhexane
1.5	Acetylene	---	2,2,3-Trimethylpentane
6.0	Propane	0.5	n-Heptane
0.5	Propene	0.5	Methylcyclohexane
1.5	i-Butane	---	2,4-Dimethylhexane
6.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	1.5	Toluene
0.5	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
3.0	i-Pentane	1.0	n-Octane
2.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	0.5	Ethylbenzene
---	t-2-Pentene	1.0	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
1.5	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
1.0	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	---	o-Ethyltoluene
1.0	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	0.5	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
1.0	Methylcyclopentane	---	Methylstyrene
0.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
1.0	Benzene	---	1,4-Diethylbenzene
0.5	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.5	5
Σ Aromatic	7.5	16
Σ Paraffin	34.0	76
Acetylene	1.5	3
	45	

TABLE C108. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER OUT OF PLUME ON 7-25-77

ug/m^3	**Hydrocarbon**	ug/m^3	**Hydrocarbon**
3.0	**Ethane**		
0.5	**Ethylene**	0.5	**2,3-Dimethylpentane**
0.5	**Acetylene**	---	**3-Methylhexane**
3.0	**Propane**	---	**2,2,3-Trimethylpentane**
0.5	**Propene**	---	**n-Heptane**
1.0	**i-Butane**	---	**Methylcyclohexane**
2.0	**n-Butane**	---	**2,4-Dimethylhexane**
0.5	**1-Butene**	---	**2,3,4-Trimethylpentane**
---	**i-Butene**	0.5	**Toluene**
---	**t-2-Butene**	---	**2,3-Dimethylhexane**
---	**c-2-Butene**	---	**2-Methylheptane**
1.5	**i-Pentane**	---	**3-Ethylhexane**
1.0	**n-Pentane**	---	**n-Octane**
0.5	**1-Pentene**	---	**Ethylcyclohexane**
---	**t-2-Pentene**	---	**Ethylbenzene**
---	**c-2-Pentene**	---	**p & m-Xylene**
---	**Cyclopentene**	---	**Styrene**
---	**Cyclopentane**	0.5	**o-Xylene**
---	**2,3-Dimethylbutane**	---	**n-Nonane**
0.5	**2-Methylpentane**	0.5	**i-Propylbenzene**
---	**c-4-Methyl-2-pentene**	---	**n-Propylbenzene**
---	**3-Methylpentane**	---	**p-Ethyltoluene**
---	**1-Hexene**	---	**m-Ethyltoluene**
0.5	**n-Hexane**	---	**o-Ethyltoluene**
---	**t-2-Hexene**	---	**1,3,5-Trimethylbenzene**
---	**c-2-Hexene**	1.0	**1,2,4-Trimethylbenzene**
---	**Methylcyclopentane**	---	**1,2,3-Trimethylbenzene**
0.5	**2,4-Dimethylpentane**	---	**Methylstyrene**
1.0	**Benzene**	---	**1,3-Diethylbenzene**
---	**Cyclohexane**	---	**1,4-Diethylbenzene**

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	2.0	10
Σ Aromatic	3.5	18
Σ Paraffin	13.5	71
Acetylene	0.5	2
	19.0	

TABLE C109. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TREILER OUT OF PLUME ON 7-26-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
1.5	Ethane	---	2,3-Dimethylpentane
---	Ethylene	---	3-Methylhexane
---	Acetylene	---	2,2,3-Trimethylpentane
0.5	Propane	---	n-Heptane
---	Propene	---	Methylcyclohexane
0.5	i-Butane	---	2,4-Dimethylhexane
1.0	n-Butane	---	2,3,4-Trimethylpentane
0.5	1-Butene	0.5	Toluene
---	i-Butene	---	2,3-Dimethylhexane
---	t-2-Butene	---	2-Methylheptane
---	c-2-Butene	---	3-Ethylhexane
0.5	i-Pentane	---	n-Octane
0.5	n-Pentane	---	Ethylcyclohexane
---	1-Pentene	---	Ethylbenzene
---	t-2-Pentene	---	p & m-Xylene
---	c-2-Pentene	---	Styrene
---	Cyclopentene	0.5	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
---	2-Methylpentane	0.5	n-Propylbenzene
---	c-4-Methyl-2-pentene	---	p-Ethyltoluene
---	3-Methylpentane	---	m-Ethyltoluene
---	1-Hexene	0.5	o-Ethyltoluene
---	n-Hexane	---	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
---	Methylcyclopentane	---	Methylstyrene
---	2,4-Dimethylpentane	---	1,3-Diethylbenzene
0.5	Benzene	---	1,4-Diethylbenzene
---	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	0.5	6
Σ Aromatic	3.5	41
Σ Paraffin	4.5	53
Acetylene	---	-
	8.5	

TABLE C110. INDIVIDUAL HYDROCARBON CONCENTRATIONS IN GROUND LEVEL SAMPLE COLLECTED AT WSU TRAILER ON 7-28-77

ug/m^3	Hydrocarbon	ug/m^3	Hydrocarbon
6.0	Ethane	2.5	2,3-Dimethylpentane
1.0	Ethylene	1.5	3-Methylhexane
0.6	Acetylene	1.5	2,2,3-Trimethylpentane
10.0	Propane	2.0	n-Heptane
0.5	Propene	1.0	Methylcyclohexane
3.0	i-Butane	0.5	2,4-Dimethylhexane
9.5	n-Butane	0.5	2,3,4-Trimethylpentane
0.5	1-Butene	4.5	Toluene
0.5	i-Butene	0.5	2,3-Dimethylhexane
0.5	t-2-Butene	1.0	2-Methylheptane
0.5	c-2-Butene	1.5	3-Ethylhexane
5.0	i-Pentane	1.0	n-Octane
3.5	n-Pentane	---	Ethylcyclohexane
0.5	1-Pentene	1.0	Ethylbenzene
0.5	t-2-Pentene	3.5	p & m-Xylene
---	c-2-Pentene	0.5	Styrene
---	Cyclopentene	1.0	o-Xylene
---	Cyclopentane	---	n-Nonane
---	2,3-Dimethylbutane	---	i-Propylbenzene
---	2-Methylpentane	1.0	n-Propylbenzene
---	c-4-Methyl-2-pentene	0.5	p-Ethyltoluene
1.0	3-Methylpentane	1.0	m-Ethyltoluene
---	1-Hexene	2.0	o-Ethyltoluene
1.5	n-Hexane	0.5	1,3,5-Trimethylbenzene
---	t-2-Hexene	1.0	1,2,4-Trimethylbenzene
---	c-2-Hexene	---	1,2,3-Trimethylbenzene
2.5	Methylcyclopentane	---	Methylstyrene
1.5	2,4-Dimethylpentane	---	1,3-Diethylbenzene
2.0	Benzene	---	1,4-Diethylbenzene
1.0	Cyclohexane		

Total Identified Hydrocarbons	ug/m^3	%
Σ Olefin	4.5	5
Σ Aromatic	18.5	23
Σ Paraffin	58.0	71
Acetylene	0.5	1
	81	

APPENDIX D

Results of natural sunlight bag irradiations of captured air samples are summarized in Appendix D. Fluctuation in O_3, NO, and NO_2 are plotted versus time for each irradiation conducted during the study.

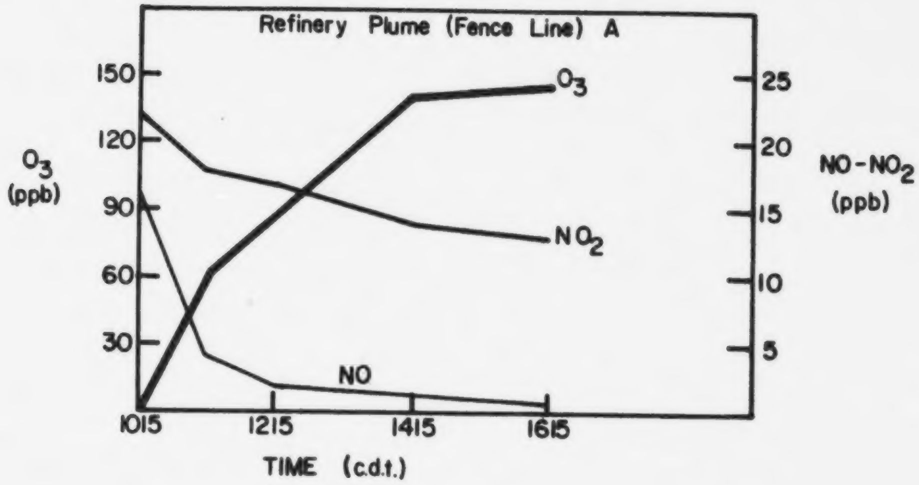

Figure D1. Results of natural sunlight bag irradiations on June 28, 1977

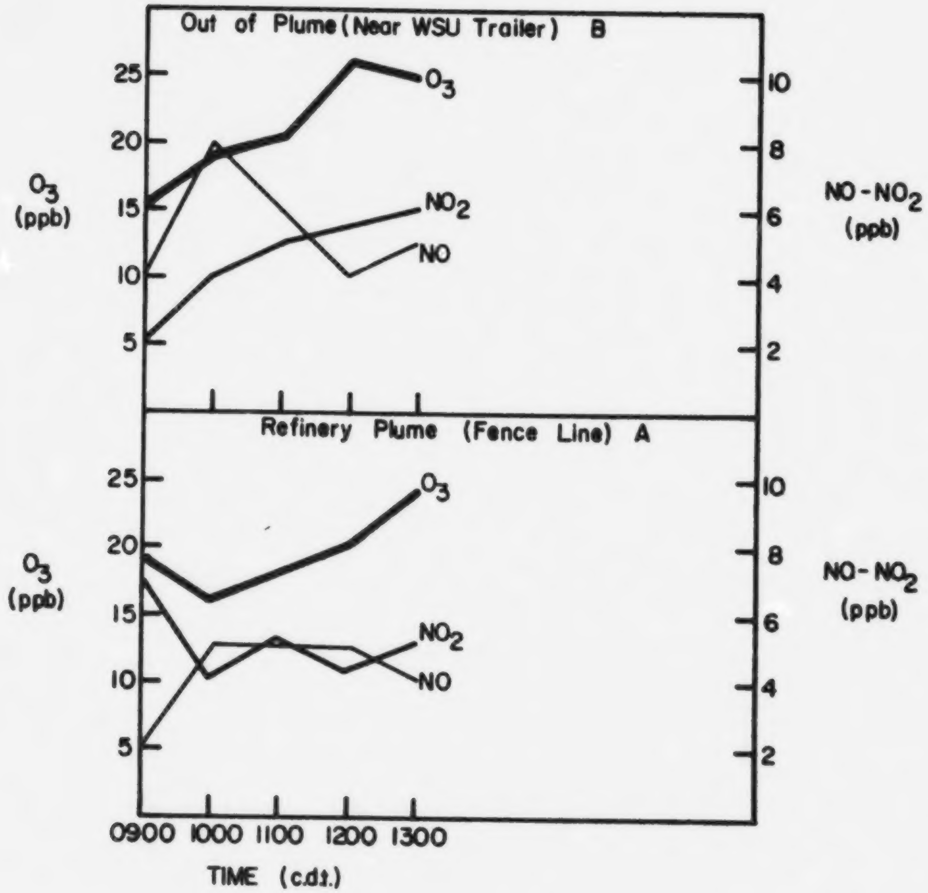

Figure D2. Results of natural sunlight bag irradiations on June 28, 1977

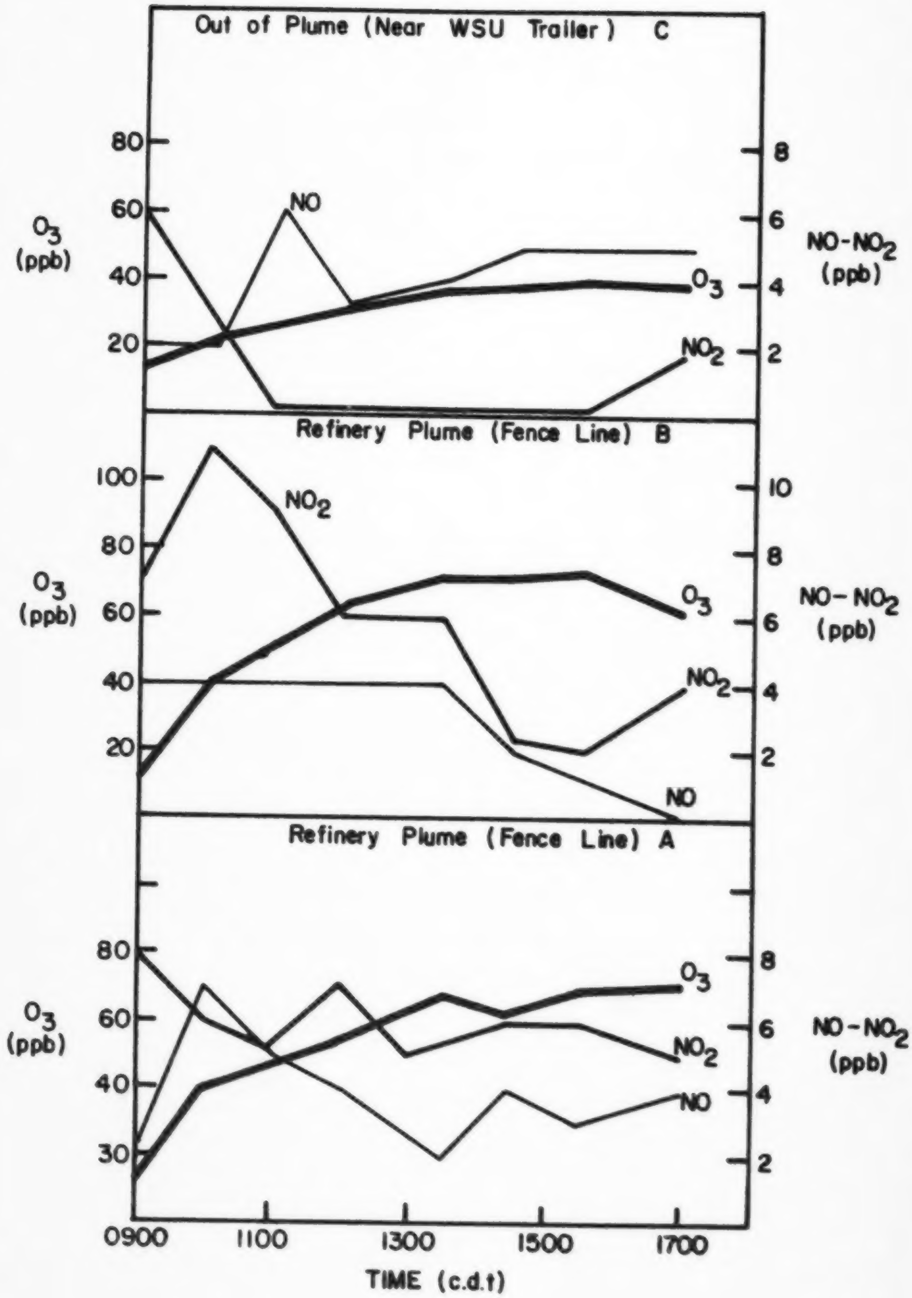

Figure D3. Results of natural sunlight bag irradiations on June 29, 1977

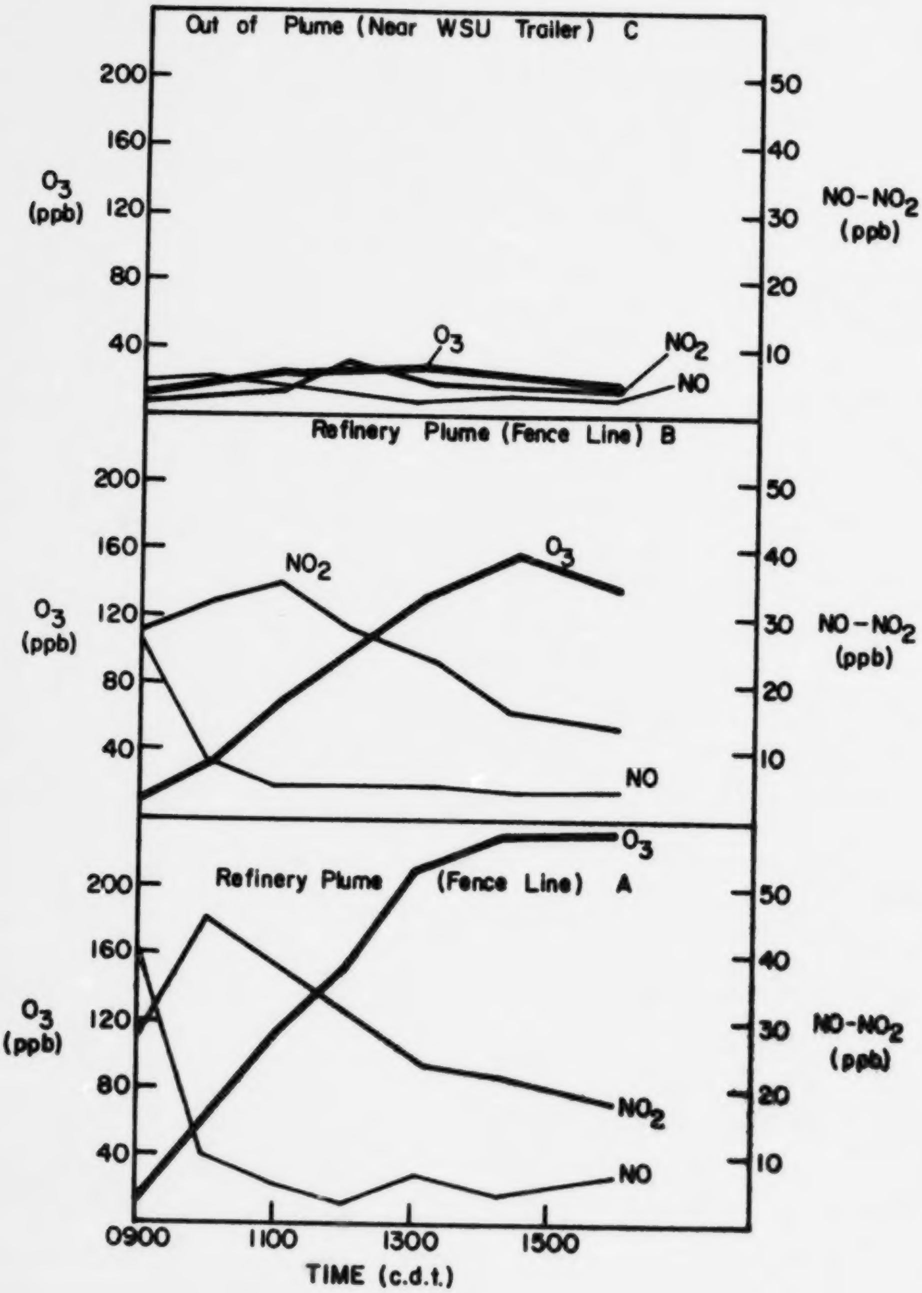

Figure D4. Results of natural sunlight bag irradiations on June 30, 1977

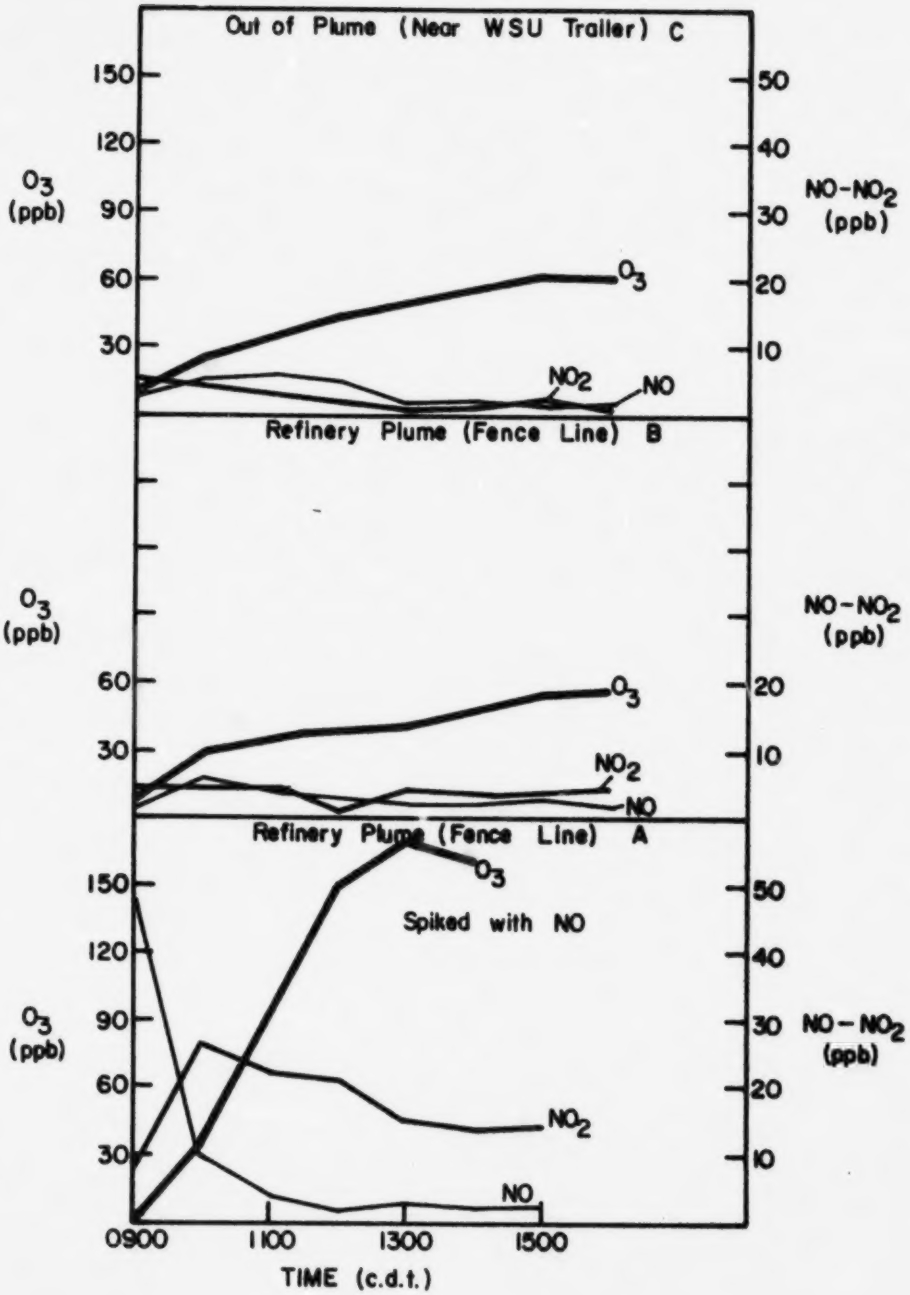

Figure D5. Results of natural sunlight bag irradiations on July 1, 1977

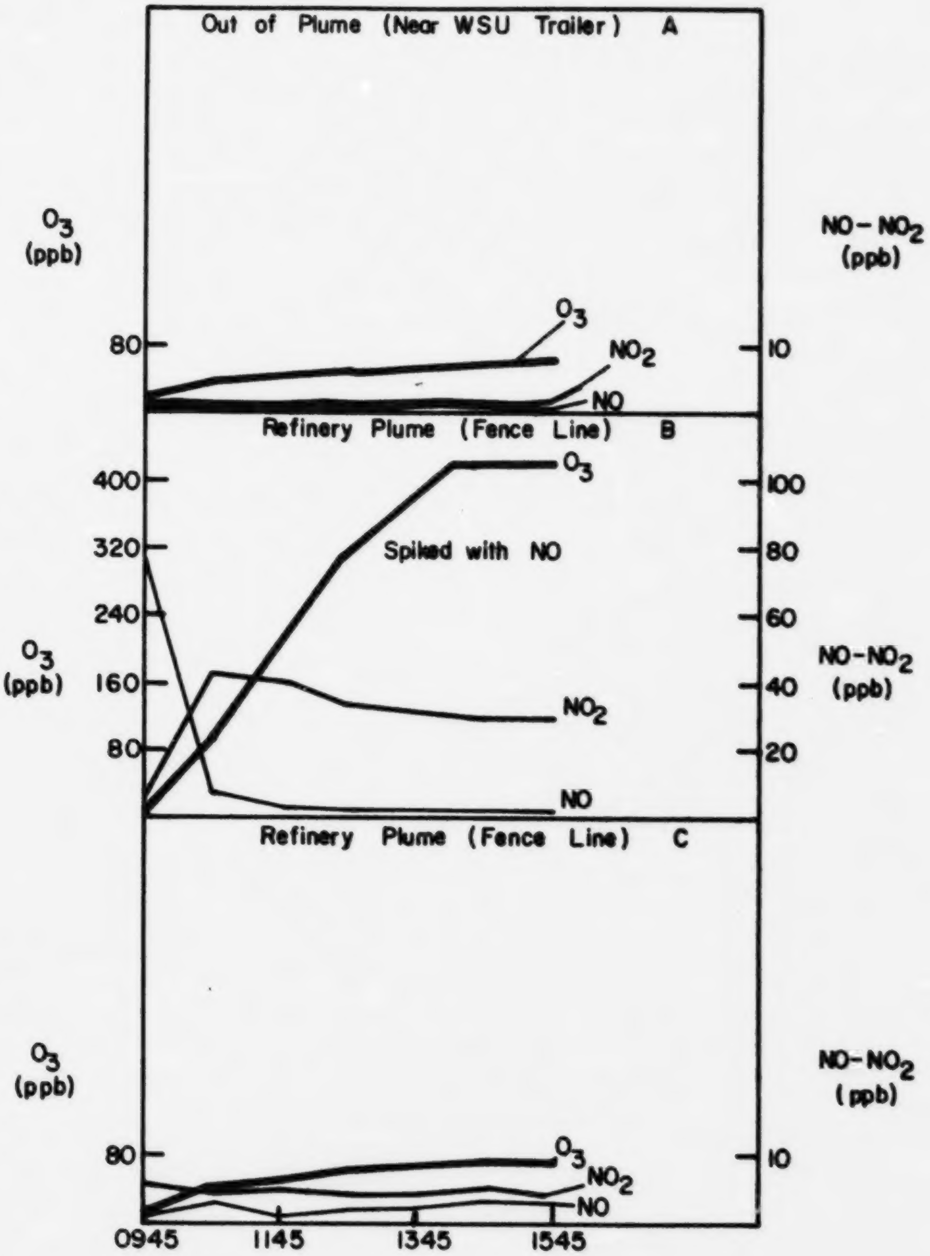

Figure D6. Results of natural sunlight bag irradiations on July 2, 1977

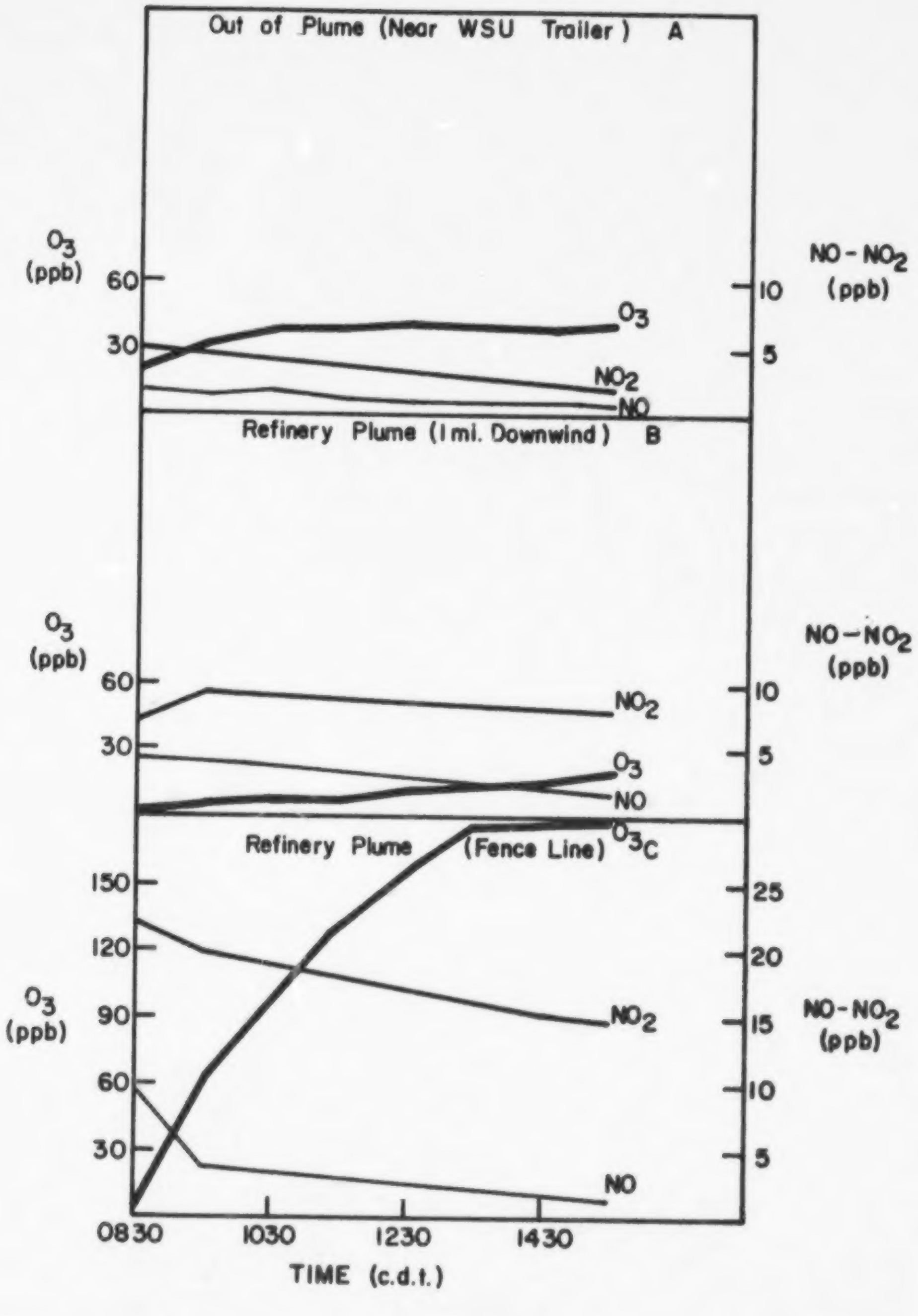

Figure D7. Results of natural sunlight bag irradiations on July 3, 1977

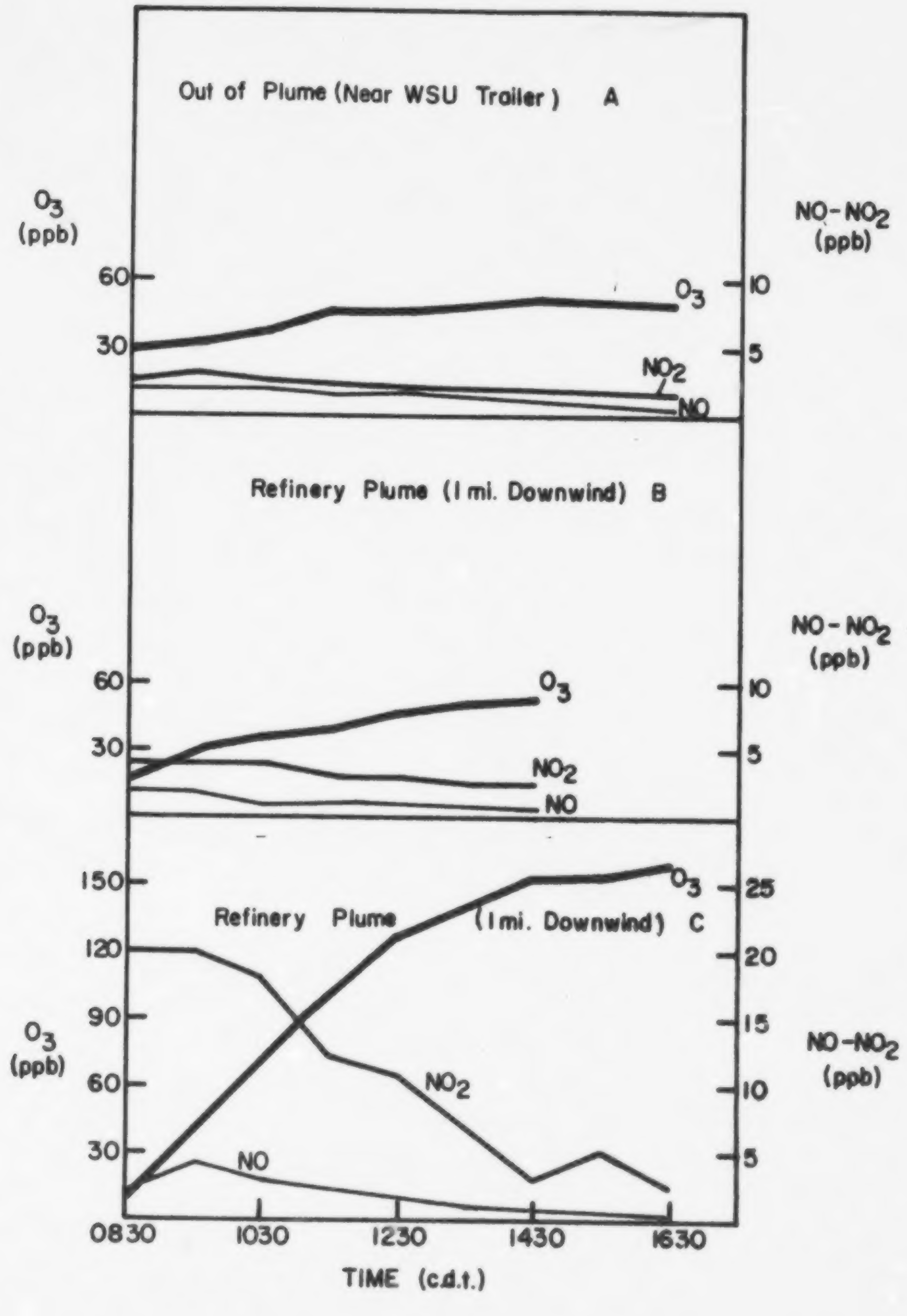

Figure D8. Results of natural sunlight bag irradiations on July 4, 1977

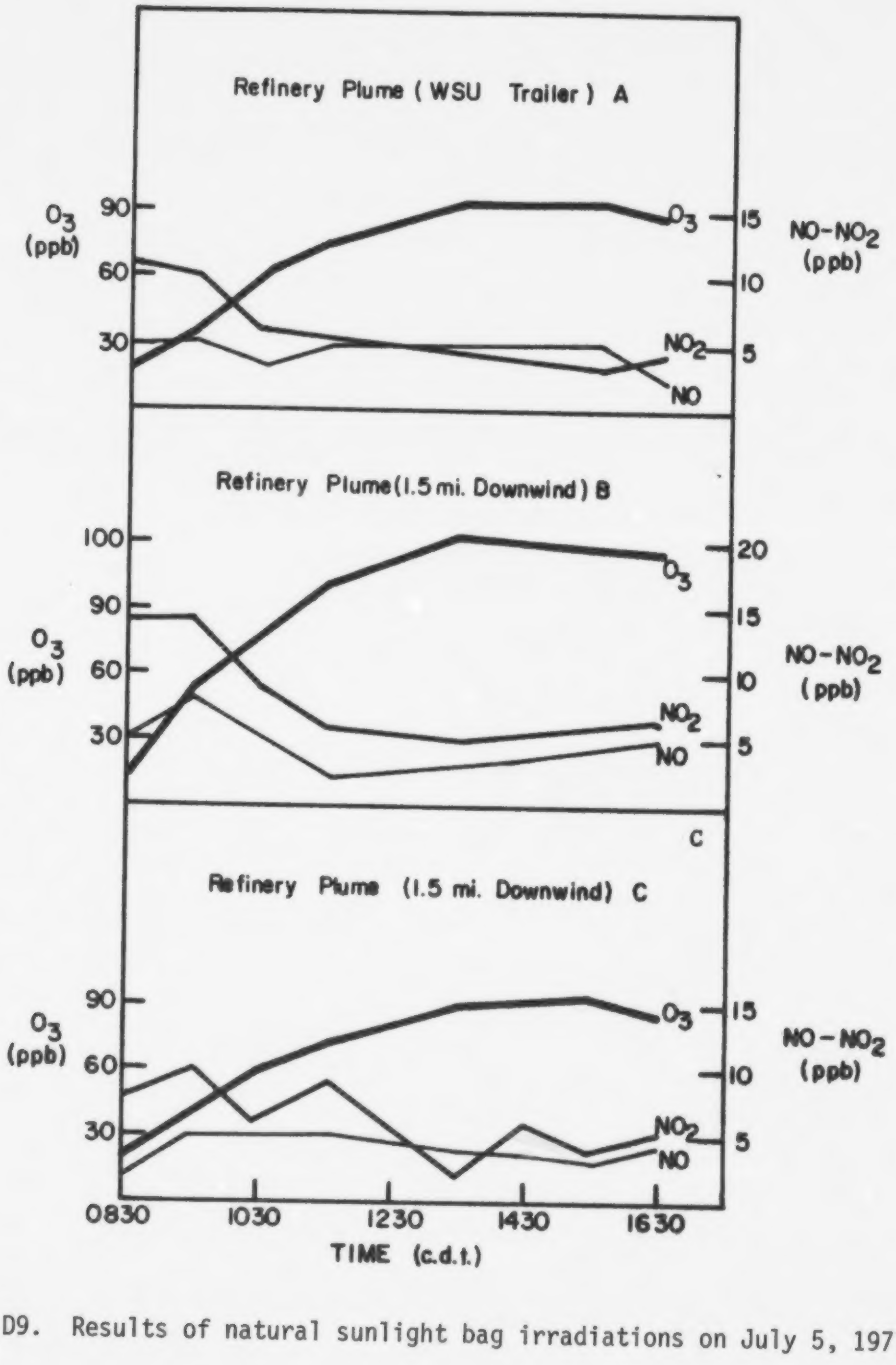

Figure D9. Results of natural sunlight bag irradiations on July 5, 1977

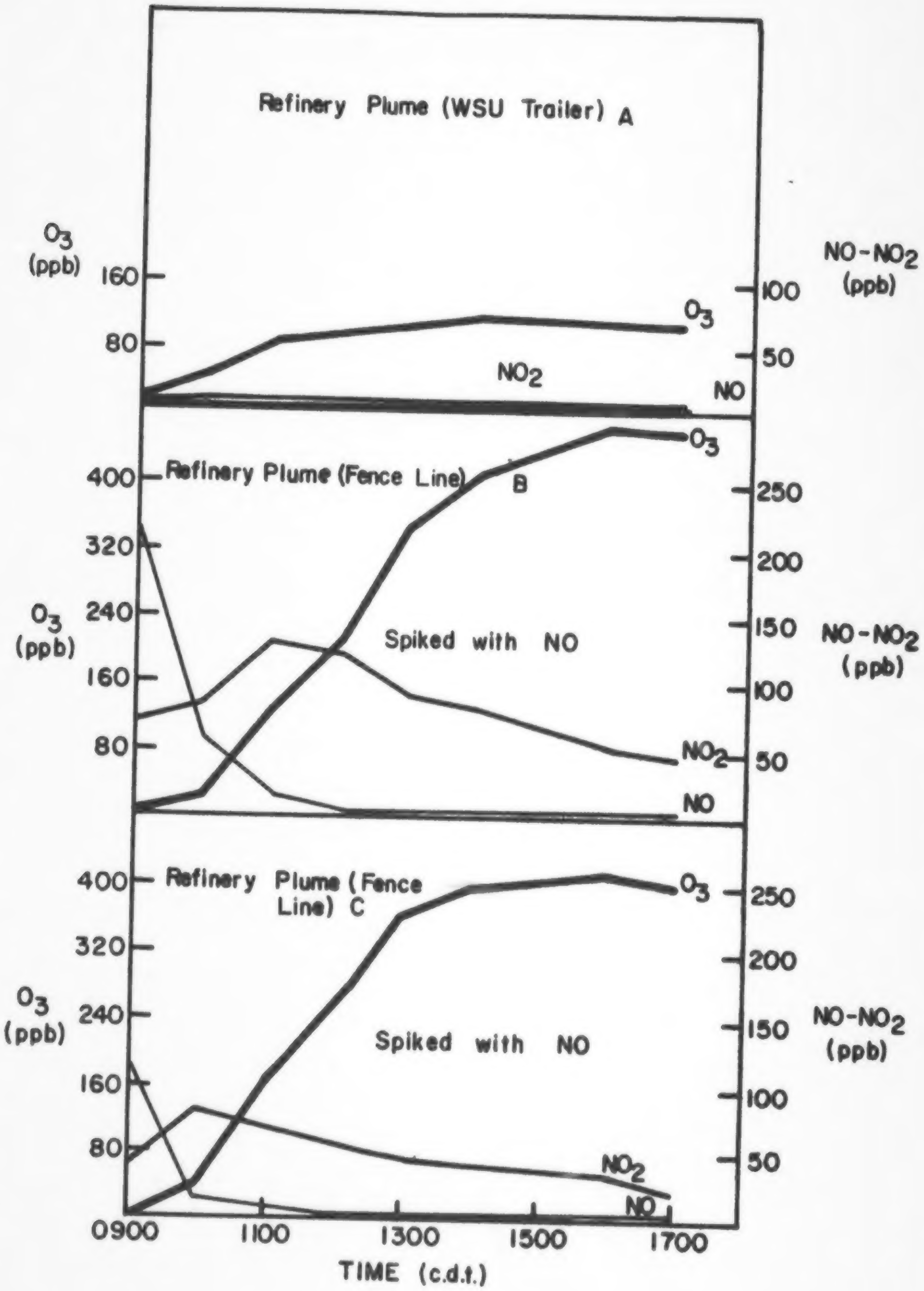

Figure D10. Results of natural sunlight bag irradiations on July 7, 1977

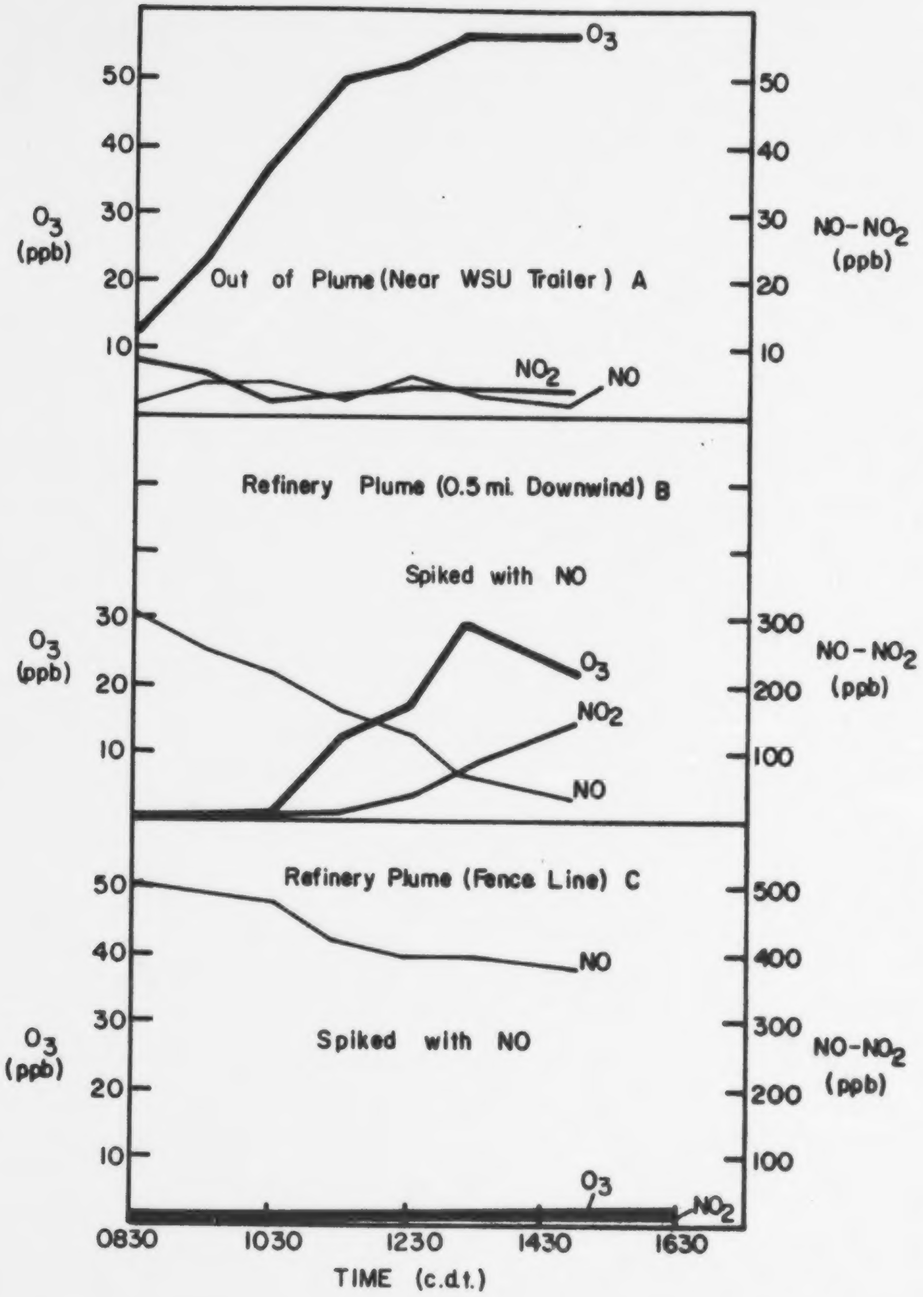

Figure D11. Results of natural sunlight bag irradiations on July 8, 1977

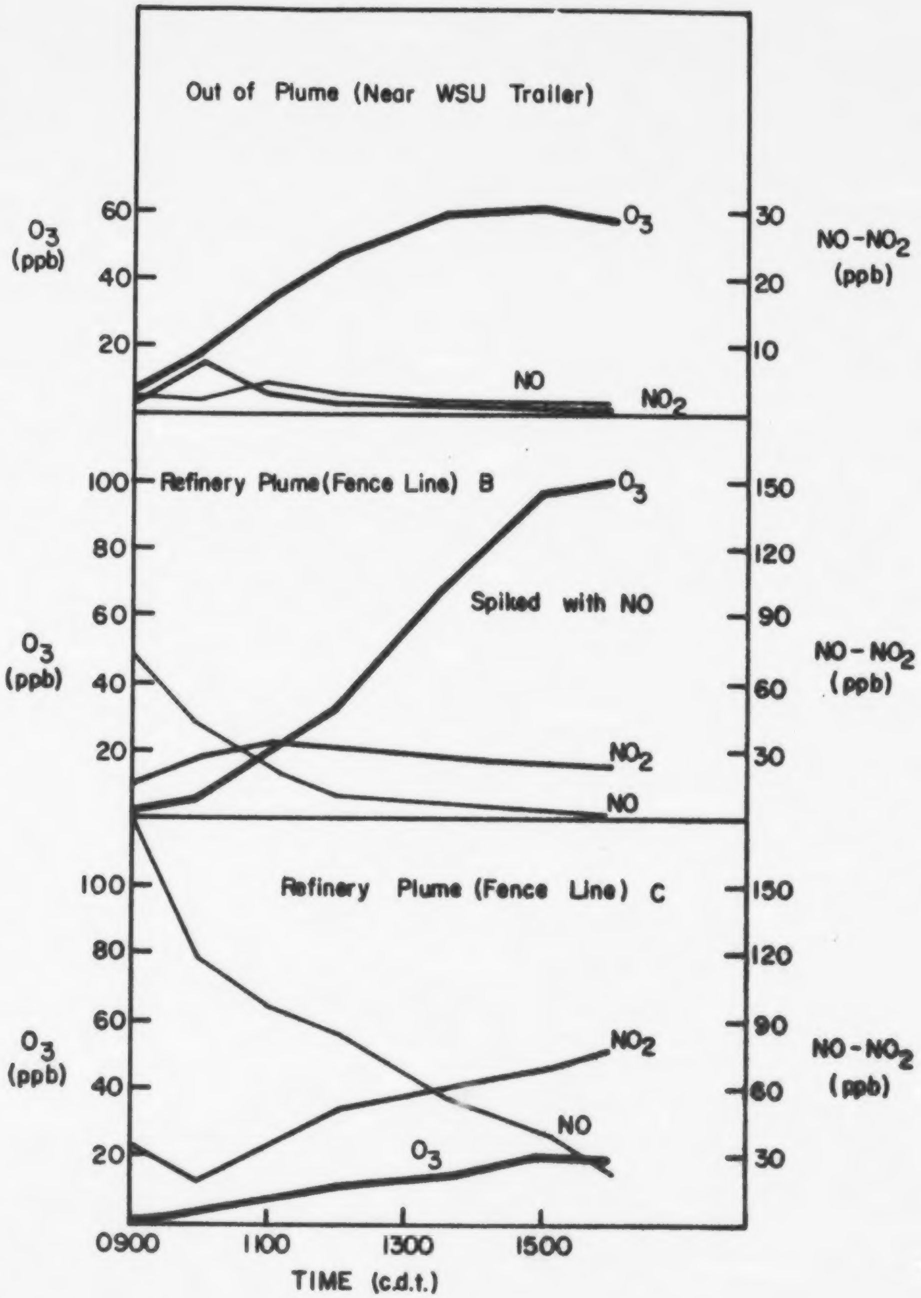

Figure D12. Results of natural sunlight bag irradiations on July 14, 1977

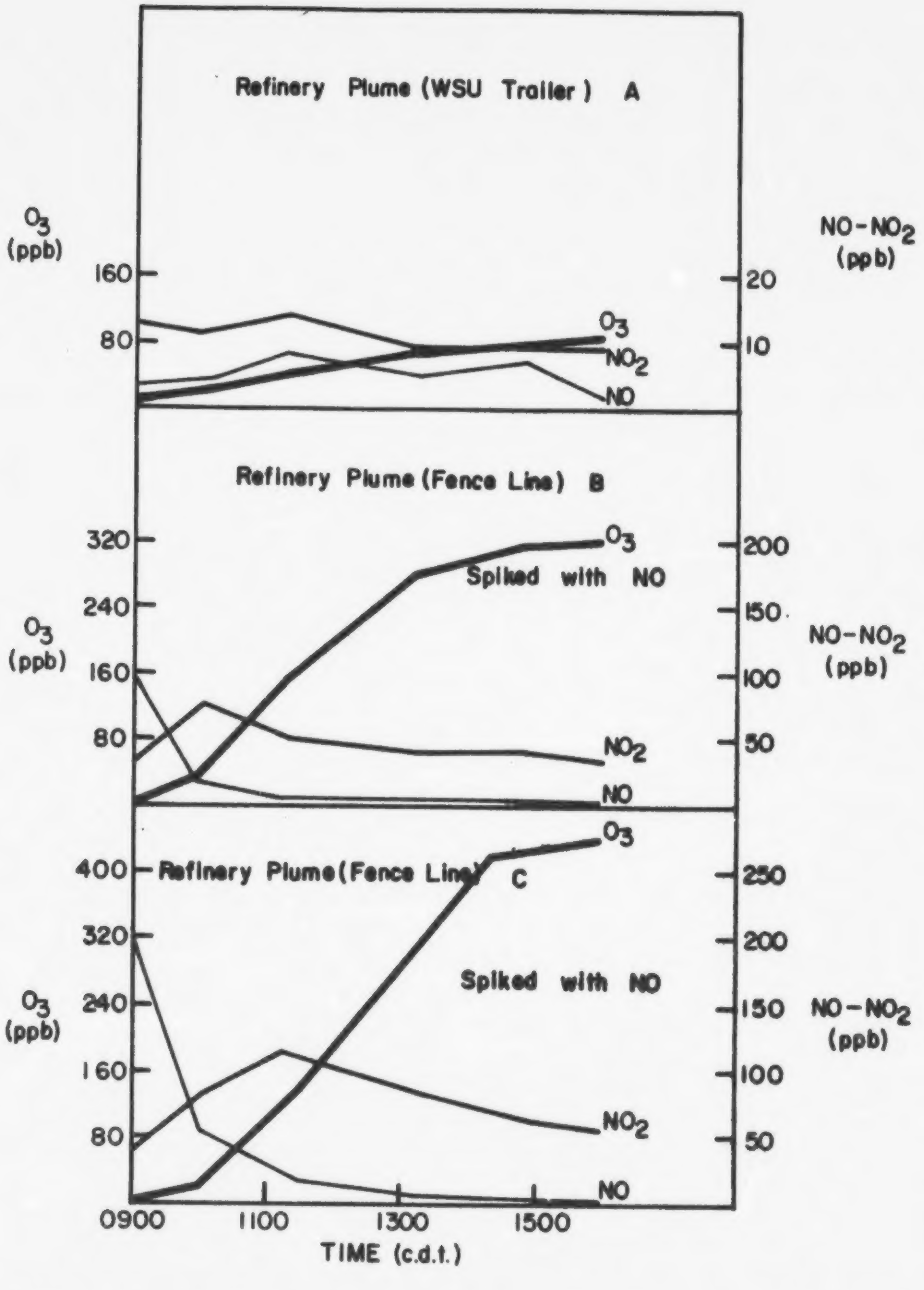

Figure D13. Results of natural sunlight bag irradiations on July 15, 1977

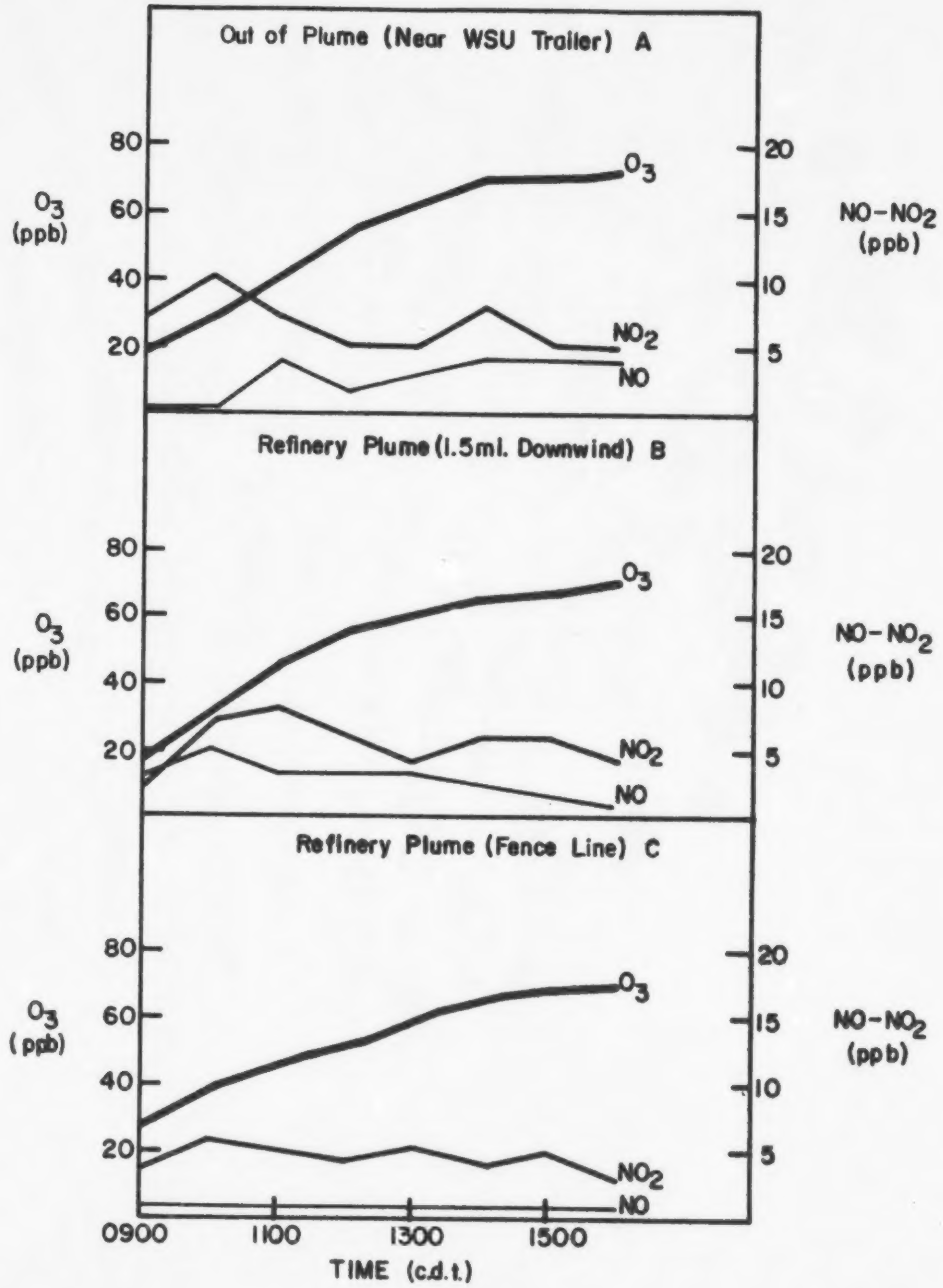

Figure D14. Results of natural sunlight bag irradiations on July 18, 1977

APPENDIX E

Acoustical sounder tracings recorded between 6-18-77 and 7-28-77 are contained in this section. The acoustical radar was located adjacent to the WSU field laboratory at the Robinson Airport.

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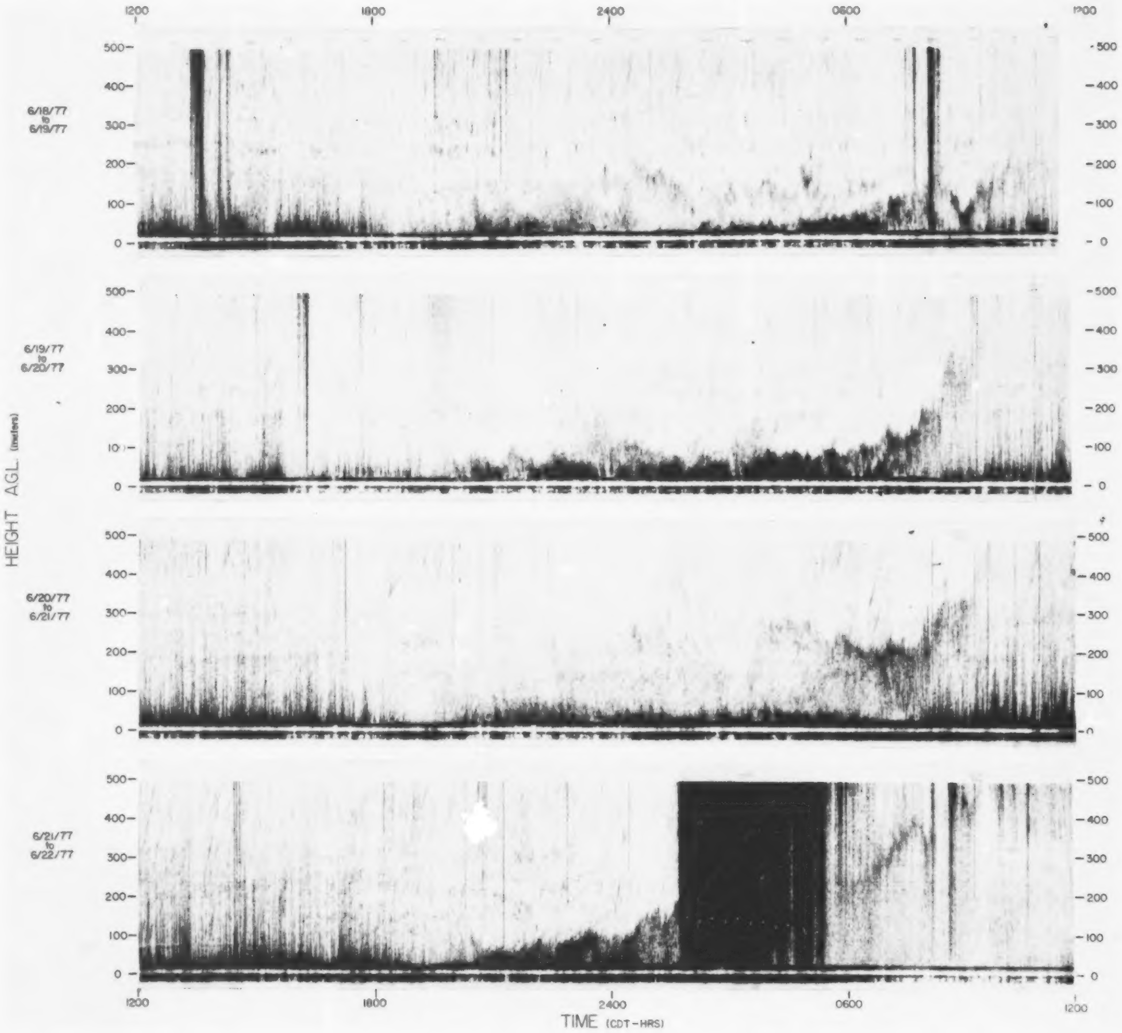

Figure E1 . Acoustical sounder tracings recorded at the Robinson Airport between 6-18-77 and 6-22-77

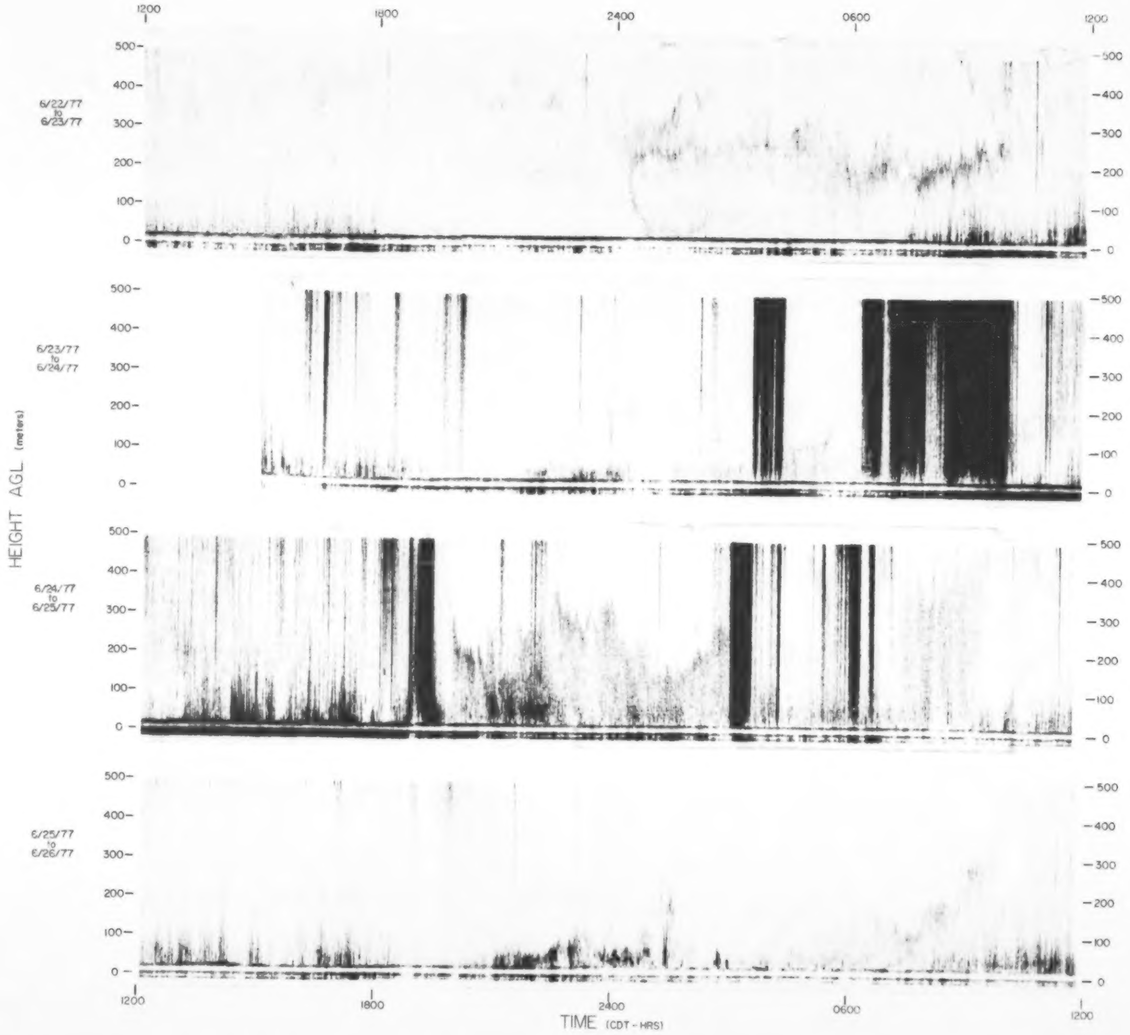

Figure E2 . Acoustical sounder tracings recorded at the Robinson Airport between 6-22-77 & 6-26-77

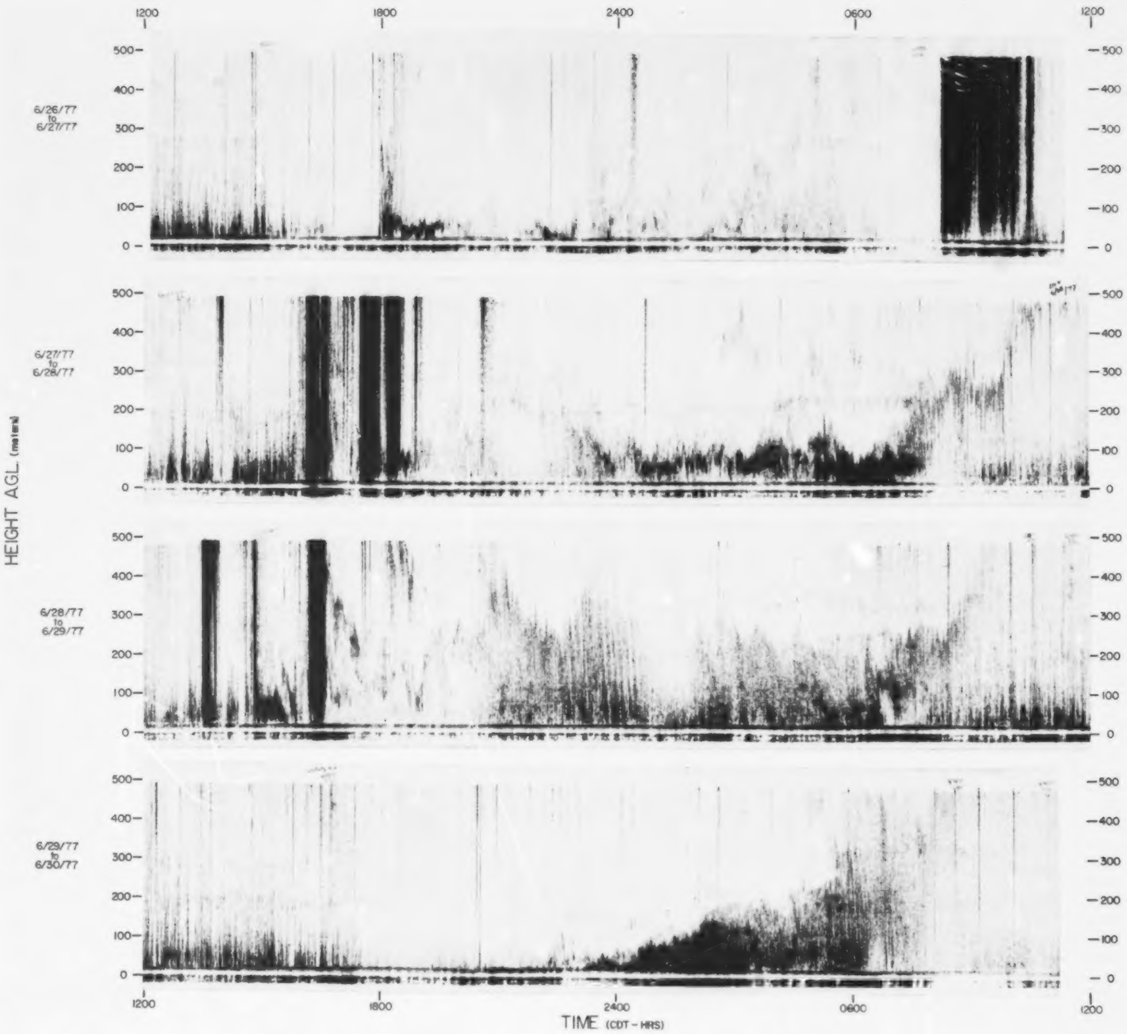

Figure E 3 Acoustical sounder tracings recorded at the Robinson Airport between 6-26-77 & 6-30-77

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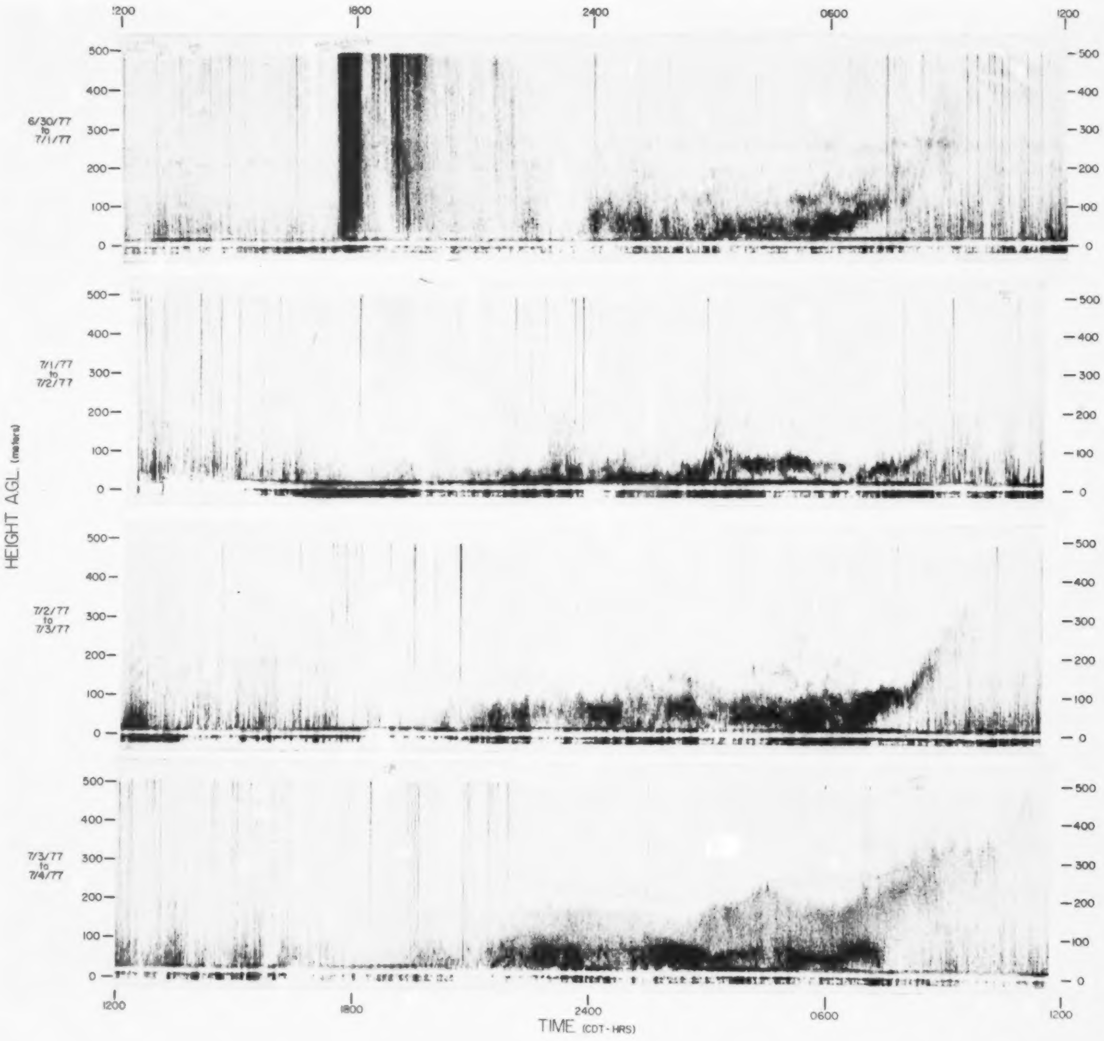

Figure E 4 . Acoustical sounder tracings recorded at the Robinson Airport between 6-30-77 & 7-4-77

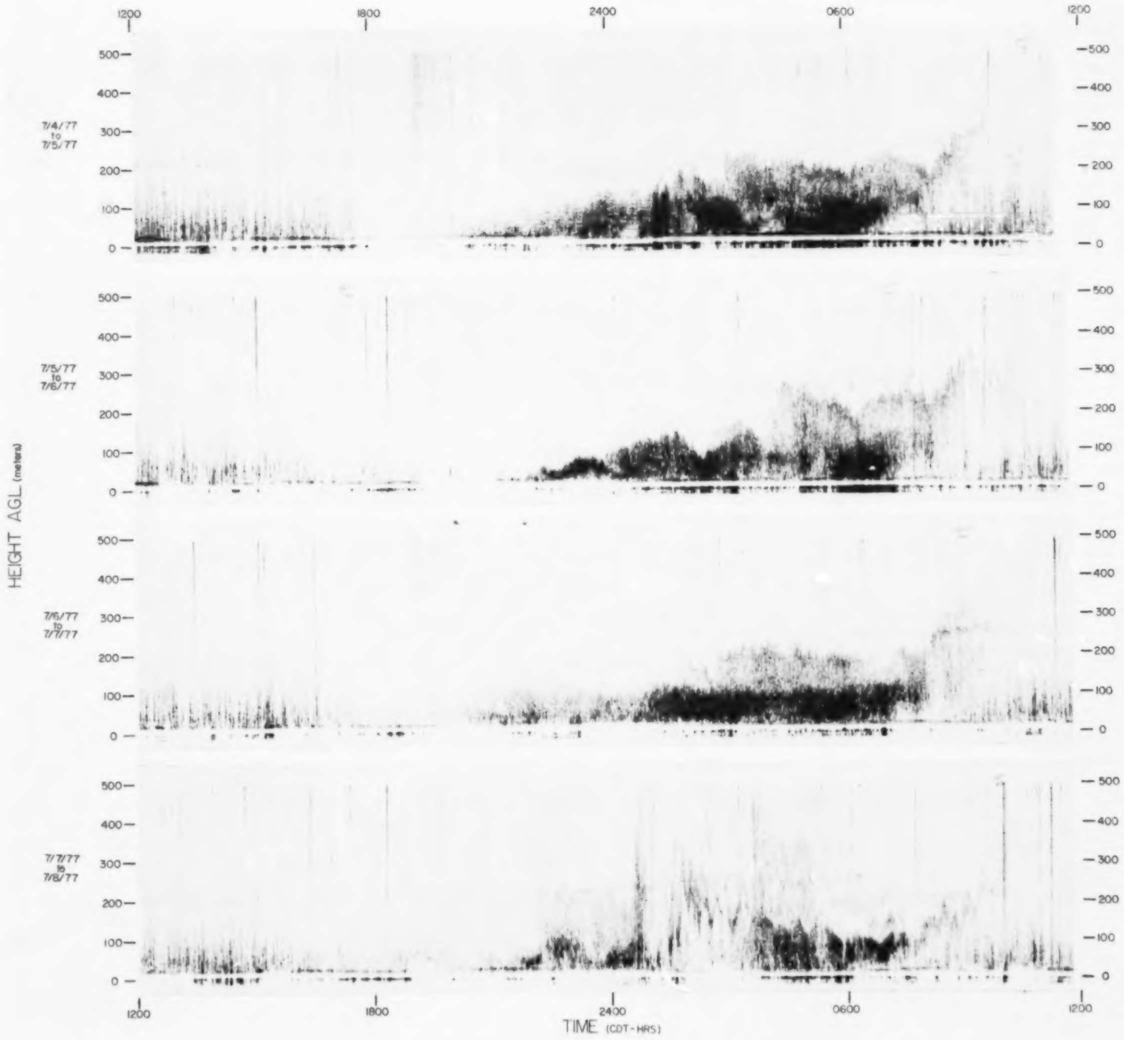

Figure E5 . Acoustical sounder tracings recorded at the Robinson Airport between 7-4-77 & 7-8-77

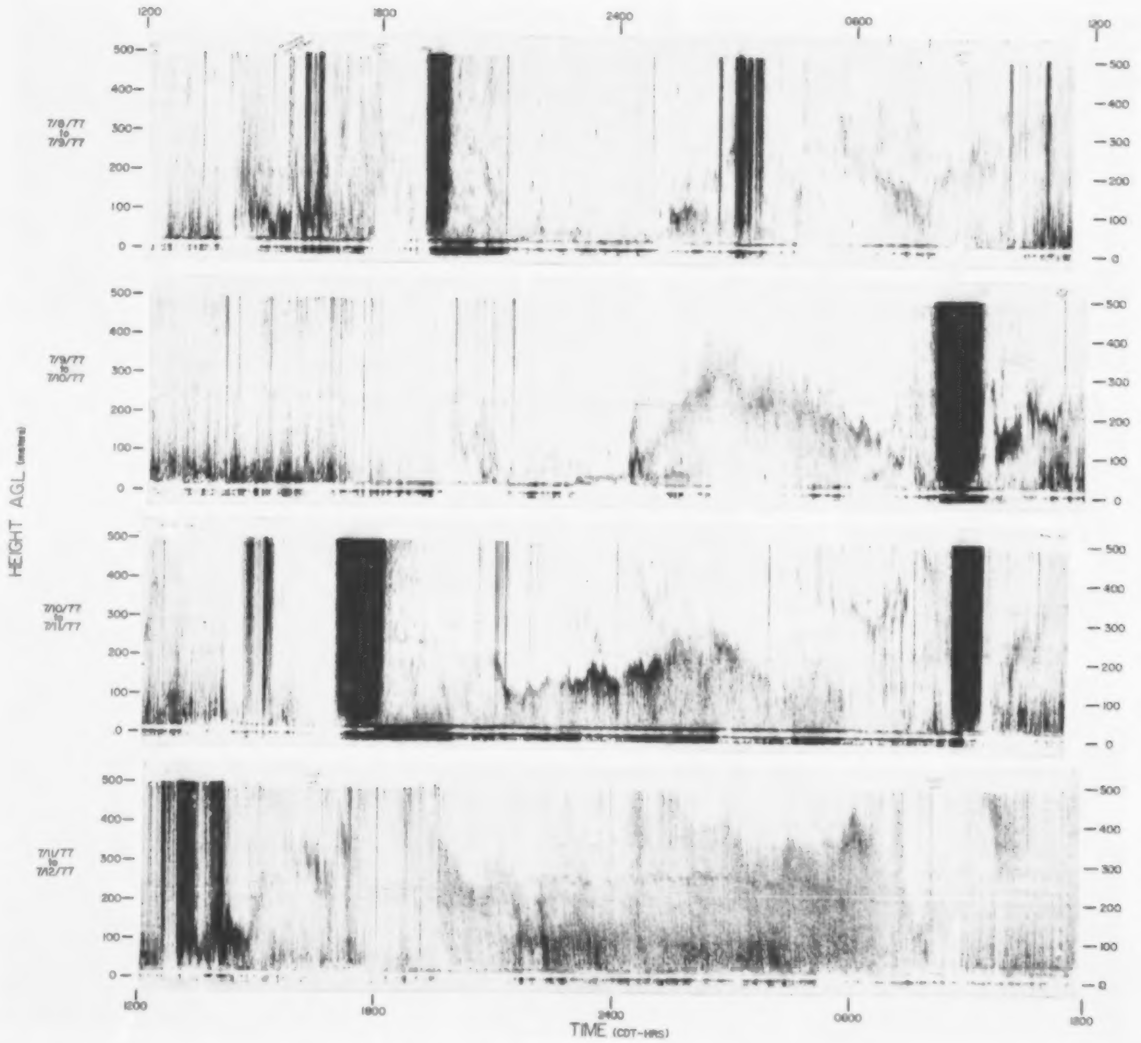

Figure E 6 Acoustical sounder tracings recorded at the Robinson Airport between 7-8-77 & 7-12-77

Reproduced from best available copy.

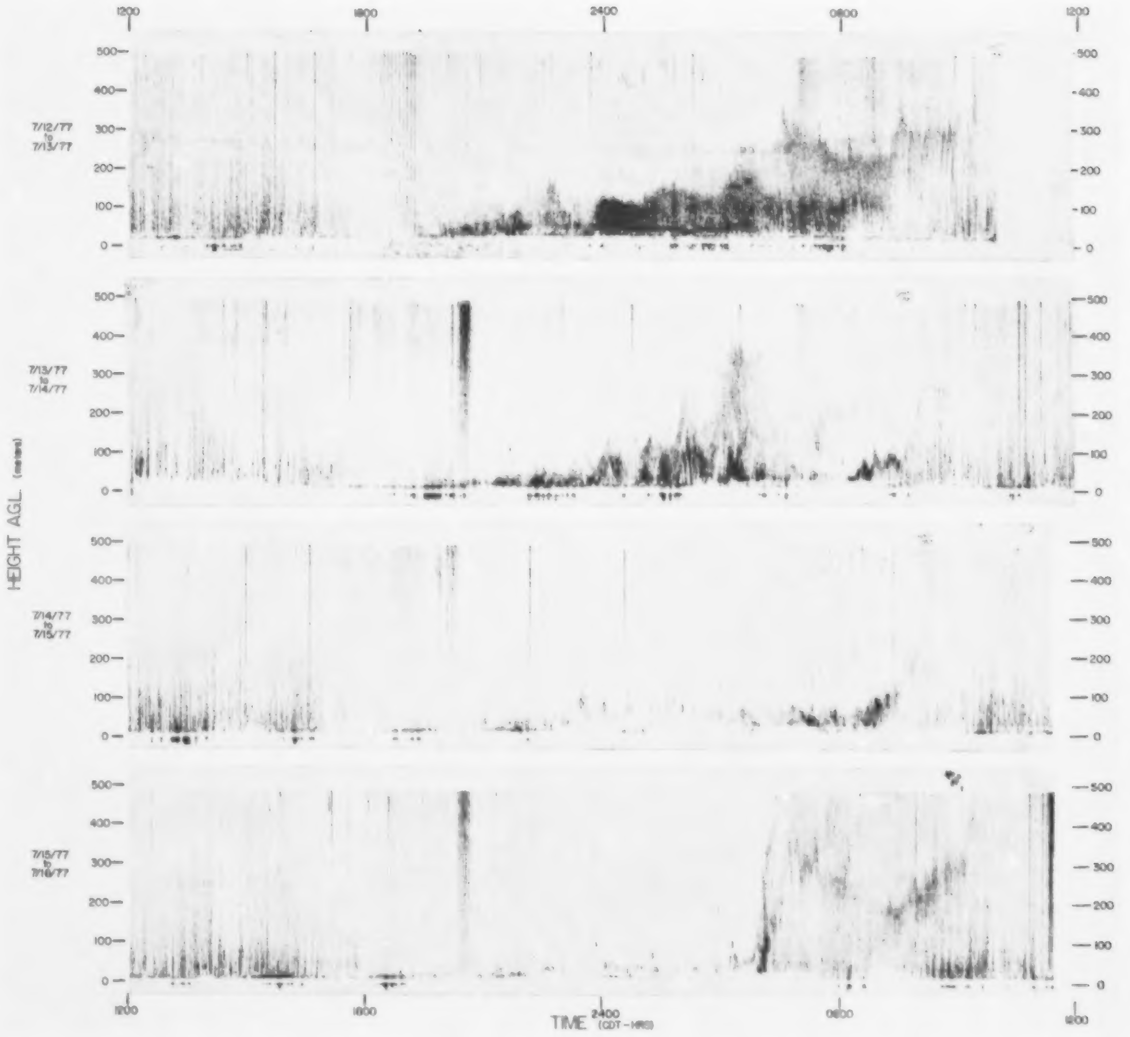

Figure E7 . Acoustical sounder tracings recorded at the Robinson Airport between 7-12-77

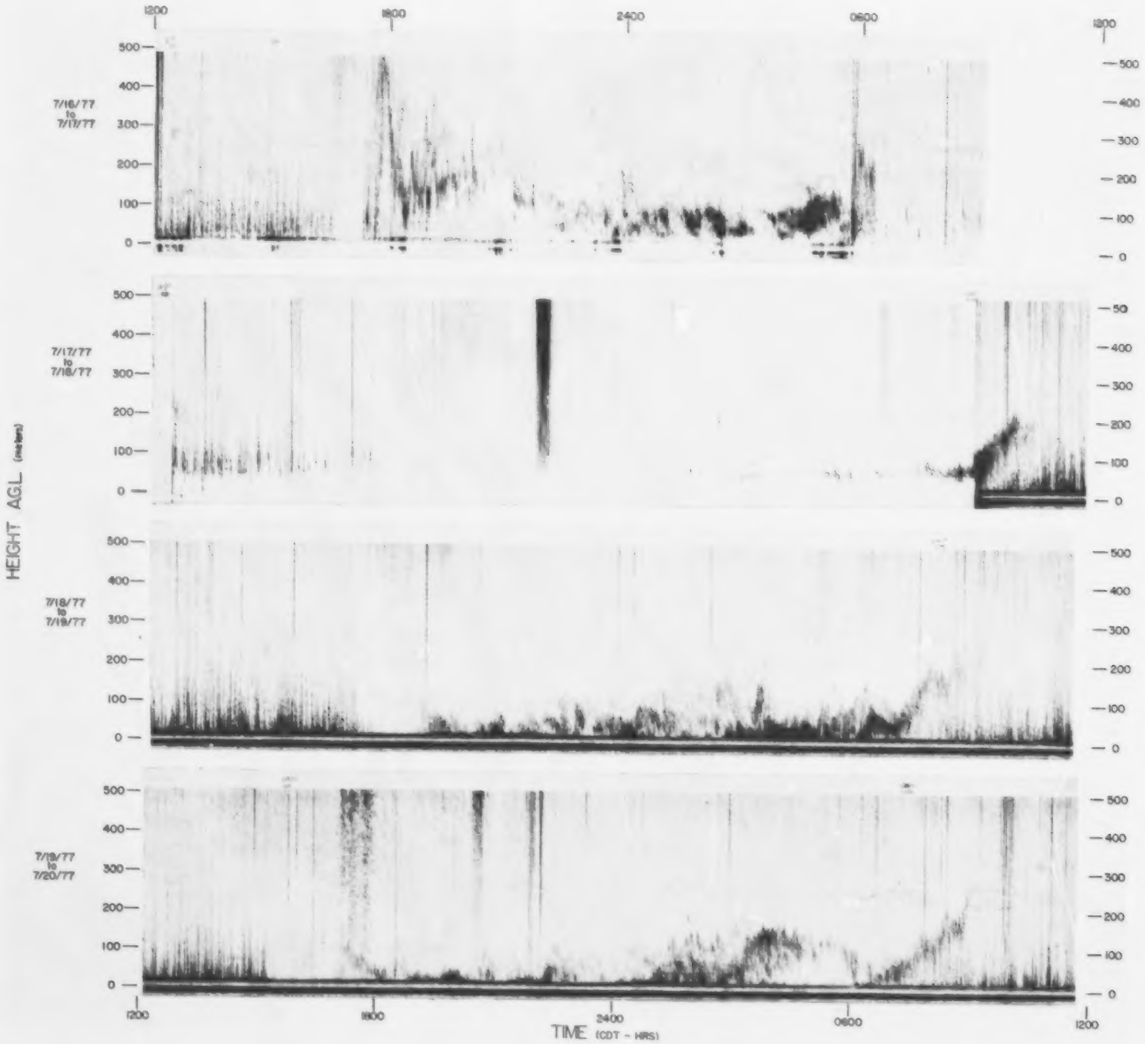

Figure E8 . Acoustical sounder tracings recorded at the Robinson Airport between 7-16-77 & 7-20-77

Reproduced from best available copy.

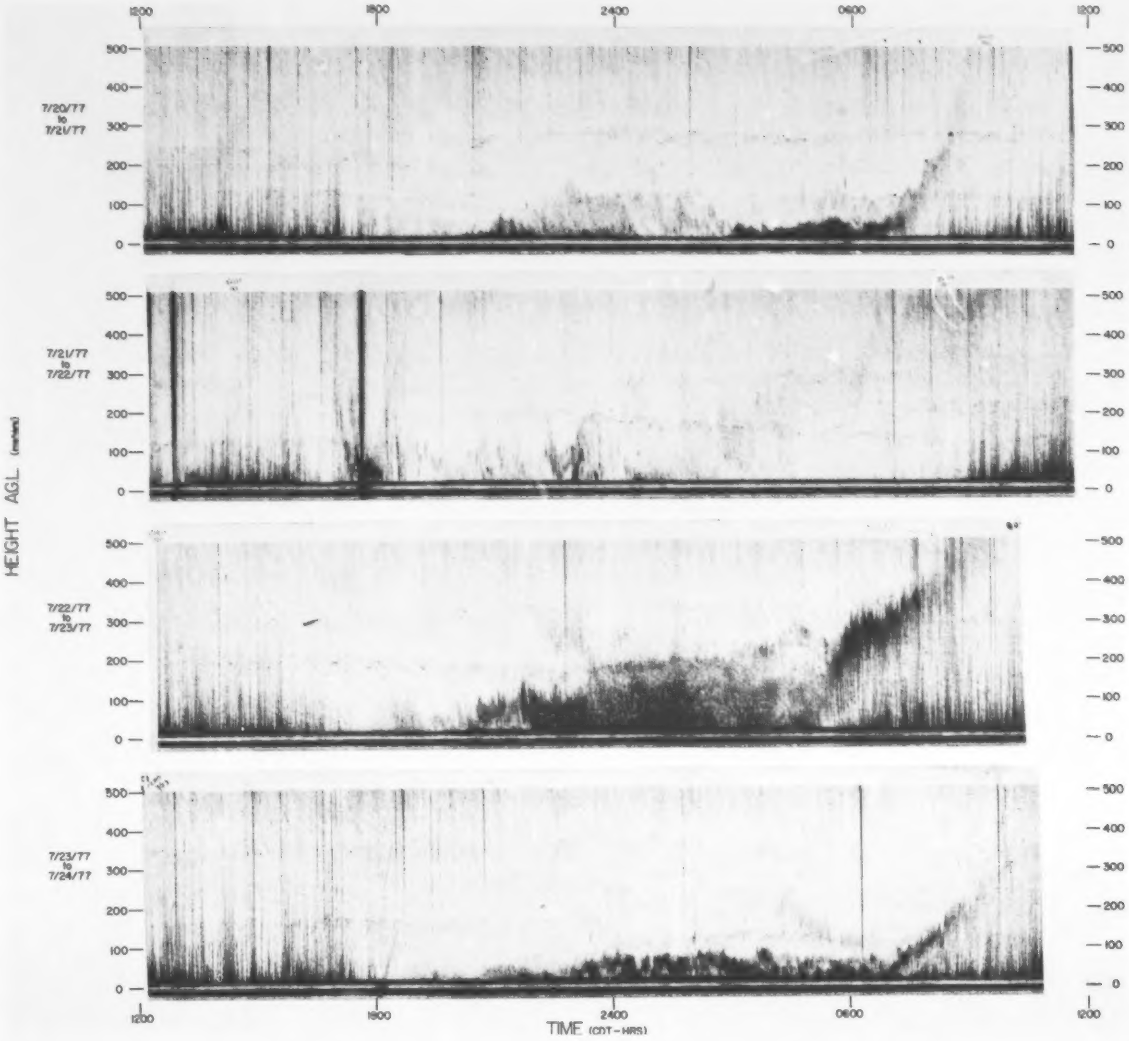

Figure E 9 . Acoustical sounder tracings recorded at the Robinson Airport between 7-20-77 & 7-24-77

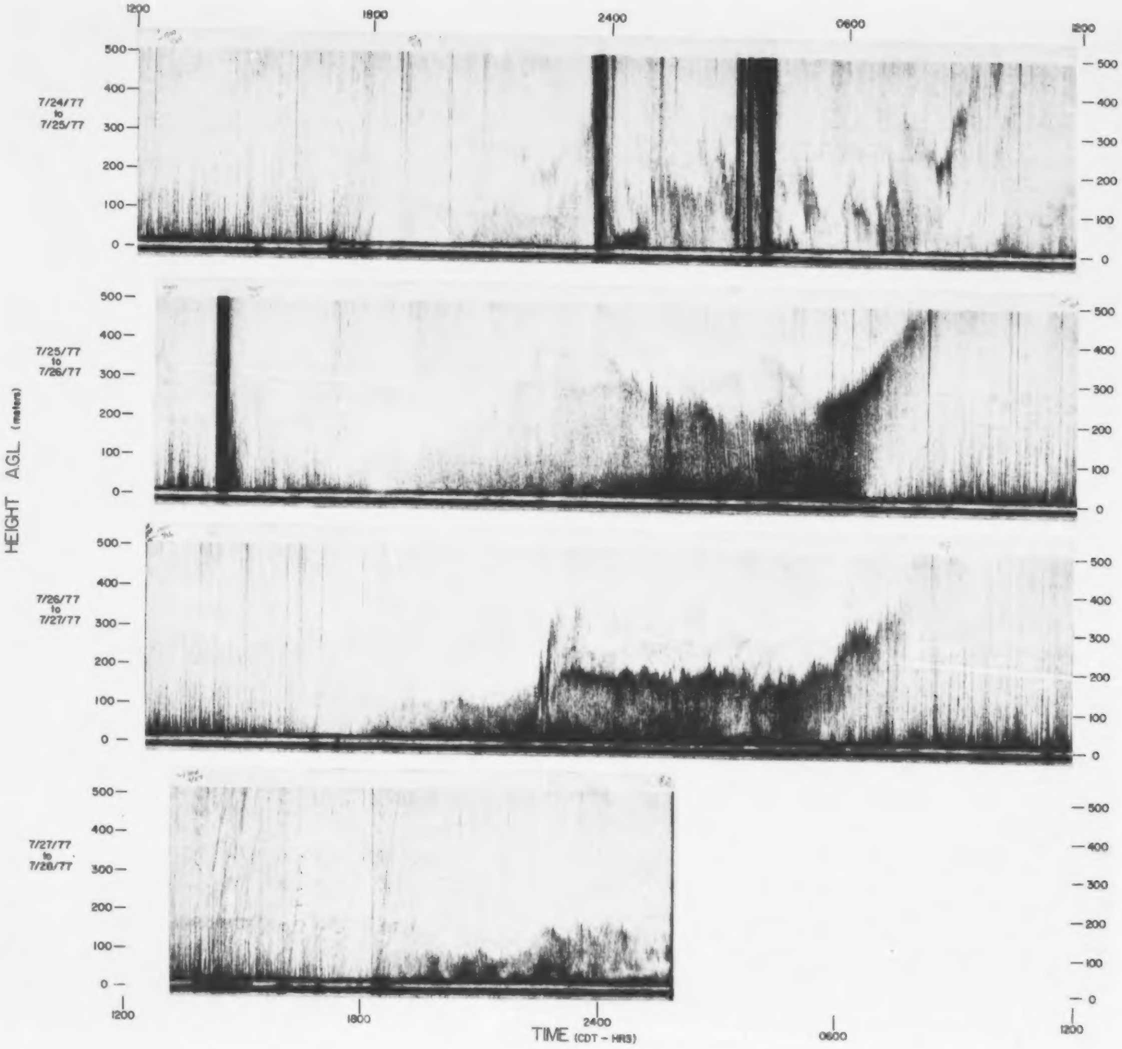

Figure E10 . Acoustical sounder tracings recorded at the Robinson Airport between 7-24-77 & 7-28-77

APPENDIX F

Upper level winds measured by pibal releases at the Robinson Airport are listed in this appendix.

Table 1· Upper Level Winds at Robinson, IL During June, 1977.

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
6/20/77	1630	182	10	295	6/20/77	1830	182	14	329
		526	9	307			526	16	329
		849	12	300			849	18	328
		1173	10	295			1173	19	328
		1496	11	302			1496	22	329
		1820	10	296			1820	24	329
		2143	8	299			2143	25	330
		2467	10	289			2467	20	329
		2790	12	289			2790	29	330
		3114	11	291			3114	25	327
		3423	18	297			3423	22	326
		3718	16	295			3718	21	324
		4015	15	296			4015	20	323
		4312	16	296			4312	22	319
		4609	17	297			4609	19	313
		4907	18	301			4907	21	310
		5204	18	300			5204	21	301
		5501	9	304			5501	18	293
		5798	33	298			5798	16	284
		6095	25	295			6095	17	289
		6392	31	289			6392	17	284
		6689	31	286			6689	27	289
		6986	32	283			6986	26	293
		7283	32	283			7283	24	290
		7580	36	275			7580	24	292
		7877	32	301			7877	32	301
		8174	31	286			8174	36	305
		8472	33	286			8472	35	303
		8769	34	288			8769	33	300
		9066	40	290			9066	34	303
		9363	42	290			9363	31	303
		9660	41	291			9660	31	301
		9957	34	287			9957	27	301
		10254	36	289			10254	33	295
		10551	37	289			10551	33	309
		10848	44	283			10848	39	279
		11145	41	282			11145	42	292
		11442	36	277			11442	37	294
		11739	37	282			11739	45	295
		12036	38	284			12036	46	295
		12334	39	284			12334	41	290
		12631	47	287			12631	42	291
		12928	41	286			12928	42	296
		13225	42	289			13225	44	296
		13522	43	292			13522	45	295

Table 2. Upper Level Winds at Robinson, IL During June, 1977.

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
6/21/77	0900	182	7	064	6/21/77	1445	182	6	066
		526	6	076			526	4	109
		849	12	068			849	5	074
		1173	12	065			1173	7	069
		1496	12	061			1496	4	069
		1820	12	044			1820	8	079
		2143	10	035			2143	9	075
		2467	8	006			2467	9	055
		2790	10	345			2790	10	046
		3114	12	350			3114	9	031
		3423	13	350			3423	14	013
		3718	12	330			3718	17	001
		4015	11	325			4015	22	347
		4312	14	324			4312	21	340
		4609					4609	32	339
		4907					4907	35	319
		5204					5204	24	313
		5501					5501	26	323
		5798					5798	26	319
		6095					6095	25	310
		6392					6392	26	306
		6689					6689	27	300
		6986					6986	28	294
		7283					7283	30	285
		7580					7580	34	287
		7877					7877	31	288
		8174					8174	34	282
		8472					8472	32	287
		8769					8769	29	286
		9066					9066	30	284
		9363					9363	26	281
		9660					9660	30	288
		9957					9957	28	290
		10254					10254	31	295
		10551					10551	32	300
		10848					10848	30	300
		11145					11145	31	298
		11442					11442	29	301
		11739					11739	26	299
		12036					12036	30	305
		12334					12334	27	310
		12631					12631	27	310
		12928					12928	28	311
		13225					13225	29	305
		13522					13522	29	308

Table 3. Upper Level Winds at Robinson, IL During June, 1977.

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
6/21/77	1915	182	5	115			182		
		526	5	101			526		
		849	5	108			849		
		1173	7	117			1173		
		1496	8	107			1496		
		1820	8	120			1820		
		2143	8	123			2143		
		2467	8	128			2467		
		2790	9	138			2790		
		3114	9	141			3114		
		3423	9	137			3423		
		3718	9	134			3718		
		4015	7	114			4015		
		4312	7	077			4312		
		4609	7	022			4609		
		4907	12	339			4907		
		5204	27	077			5204		
		5501	47	300			5501		
		5798	17	328			5798		
		6095	16	320			6095		
		6392	16	295			6392		
		6689	20	295			6689		
		6986					6986		
		7283					7283		
		7580					7580		
		7877					7877		
		8174					8174		
		8472					8472		
		8769					8769		
		9066					9066		
		9363					9363		
		9660					9660		
		9957					9957		
		10254					10254		
		10551					10551		
		10848					10848		
		11145					11145		
		11442					11442		
		11739					11739		
		12036					12036		
		12334					12334		
		12631					12631		
		12928					12928		
		13225					13225		
		13522					13522		

Table 4. Upper Level Winds at Robinson, IL During July, 1977.

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/1/77	1700	182	12	304	7/2/77	1130	182	0	012
		526	20	292			526	1	008
		849	19	292			849	2	288
		1173	20	290			1173	1	124
		1496	18	286			1496	0	270
		1820	19	288			1820	1	161
		2143	20	291			2143	2	260
		2467	20	291			2467	2	260
		2790	21	293			2790	4	277
		3114	18	294			3114	9	272
		3423	17	305			3423	11	280
		3718	15	287			3718	14	282
		4015	19	295			4015	18	284
		4312	19	293			4312	15	287
		4609	20	293			4609	15	287
		4907	19	294			4907	15	288
		5204	17	300			5204	15	298
		5501	23	305			5501	13	309
		5798	25	315			5798	13	324
		6095	25	311			6095	18	337
		6392	23	303			6392	25	347
		6689	28	301			6689	26	353
		6986	26	299			6986	23	345
		7283	27	290			7283	21	333
		7580	31	288			7580	20	316
		7877	30	285			7877	19	320
		8174	31	281			8174	18	327
		8472	28	282			8472	14	324
		8769	28	288			8769	19	317
		9066	33	292			9066	21	320
		9363	30	289			9363	21	323
		9660	31	287			9660	19	328
		9957	31	291			9957	18	323
		10254	37	289			10254	15	320
		10551	44	291			10551	15	317
		10848	40	295			10848	17	320
		11145	42	297			11145	16	320
		11442	50	293			11442	16	317
		11739	46	293			11739	43	247
		12036	57	307			12036	48	025
		12334					12334		
		12631					12631		
		12928					12928		
		13225					13225		
		13522					13522		

Table 5. Upper Level Winds at Robinson, IL During July, 1977.

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/4/77	1428	182	8	235	7/6/77	1330	182	10	115
		526	10	218			526	8	099
		849	9	227			849	7	075
		1173	13	210			1173	8	076
		1496	10	214			1496	9	087
		1820	6	202			1820	9	091
		2143	5	181			2143	9	094
		2467	8	221			2467	10	096
		2790	6	253			2790	10	094
		3114	10	245			3114	10	096
		3423	9	258			3423	7	096
		3718	12	262			3718	9	104
		4015	15	284			4015	8	103
		4312	20	278			4312	10	095
		4609	11	300			4609	10	092
		4907	15	287			4907	10	098
		5204	18	271			5204	11	094
		5501	17	285			5501	13	090
		5798	11	304			5798	14	089
		6095	12	294			6095	16	089
		6392	18	274			6392	15	094
		6689	11	271			6689	16	094
		6986	8	270			6986	16	094
		7283	8	268			7283	17	098
		7580	12	294			7580	18	100
		7877	11	249			7877	19	104
		8174	13	270			8174	20	105
		8472	11	269			8472	21	112
		8769	8	256			8769	20	122
		9066	3	245			9066	27	126
		9363	4	256			9363	29	124
		9660	2	229			9660	29	126
		9957	10	083			9957	28	120
		10254	11	255			10254	29	118
		10551	1	166			10551	25	117
		10848	3	123			10848	26	114
		11145	4	112			11145	29	118
		11442	4	130			11442	24	109
		11739	7	124			11739	5	250
		12036	13	101			12036	49	113
		12334	6	159			12334	22	121
		12631	7	134			12631	23	126
		12928	4	127			12928	21	133
		13225	4	094			13225	23	125
		13522	5	076			13522	23	119

Table 6. Upper Level Winds at Robinson, IL During July, 1977

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/7/77	1400	182	13	223	7/9/77	1000	182	--	---
		526	16	219			526	4	008
		849	11	227			849	4	031
		1173	14	236			1173	6	089
		1496	13	239			1496	6	086
		1820	14	239			1820	9	088
		2143	12	250			2143	8	087
		2467	14	245			2467	8	082
		2790	14	254			2790	5	072
		3114	15	245			3114	2	001
		3423	17	253			3423	3	048
		3718	15	259			3718	3	017
		4015	16	260			4015	5	335
		4312	18	265			4312	6	327
		4609	21	271			4609	8	312
		4907	32	277			4907	6	305
		5204	21	270			5204	6	302
		5501	29	275			5501	8	300
		5798	30	275			5798	9	287
		6095	30	278			6095		
		6392	29	279			6392		
		6689	27	283			6689		
		6986	29	289			6986		
		7283	27	289			7283		
		7580	27	283			7580		
		7877	27	282			7877		
		8174	25	275			8174		
		8472	28	275			8472		
		8769	26	274			8769		
		9066	26	268			9066		
		9363	27	265			9363		
		9660	27	268			9660		
		9957	32	265			9957		
		10254	20	271			10254		
		10551	34	274			10551		
		10848	30	276			10848		
		11145	36	275			11145		
		11442	37	273			11442		
		11739	33	274			11739		
		12036	33	274			12036		
		12334	34	272			12334		
		12631	35	272			12631		
		12928	36	269			12928		
		13225	30	266			13225		
		13522	30	266			13522		

Table 7. Upper Level Wind at Robinson, IL During July, 1977

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/10/77	1300	182	1	051	7/12/77	1700	182	10	232
		526	1	237			526	13	217
		849	1	065			849	9	207
		1173	5	069			1173	7	201
		1496	7	068			1496	5	202
		1820	7	065			1820	6	205
		2143	9	053			2143	6	207
		2467	7	039			2467	2	219
		2790	7	030			2790	2	225
		3114	5	025			3114	2	012
		3423					3423	7	031
		3718					3718	12	036
		4015					4015	7	037
		4312					4312		
		4609					4609		
		4907					4907		
		5204					5204		
		5501					5501		
		5798					5798		
		6095					6095		
		6392					6392		
		6689					6689		
		6986					6986		
		7283					7283		
		7580					7580		
		7877					7877		
		8174					8174		
		8472					8472		
		8769					8769		
		9066					9066		
		9363					9363		
		9660					9660		
		9957					9957		
		10254					10254		
		10551					10551		
		10848					10848		
		11145					11145		
		11442					11442		
		11739					11739		
		12036					12036		
		12334					12334		
		12631					12631		
		12928					12928		
		13225					13225		
		13522					13522		

Table 8. Upper Level Winds at Robinson, IL During July, 1977

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/12/77	1730	182	7	230	7/18/77	1500	182	8	200
		526	9	221			526	8	201
		849	6	203			849	9	219
		1173	5	205			1173	10	215
		1496	6	205			1496	11	221
		1820	5	210			1820	11	223
		2143	2	227			2143	9	223
		2467	0	299			2467	8	229
		2790	0	029			2790	9	239
		3114	6	035			3114	8	238
		3423	9	037			3423	6	243
		3718	7	038			3718	6	262
		4015	5	037			4015	8	266
		4312	3	034			4312	9	273
		4609	2	033			4609	9	266
		4907	0	045			4907	10	255
		5204	0	189			5204	8	268
		5501	1	027			5501	8	270
		5798	1	025			5798	8	280
		6095	1	023			6095	6	308
		6392	1	021			6392	6	269
		6689	1	020			6689	7	283
		6986	1	023			6986		
		7283	1	016			7283		
		7580	2	017			7580		
		7877	2	020			7877		
		8174	2	021			8174		
		8472	4	017			8472		
		8769	6	019			8769		
		9066	7	019			9066		
		9363	7	019			9363		
		9660	7	018			9660		
		9957	7	017			9957		
		10254	7	017			10254		
		10551	7	017			10551		
		10848	7	016			10848		
		11145	8	046			11145		
		11442	7	006			11442		
		11739	7	016			11739		
		12036	7	016			12036		
		12334	7	016			12334		
		12631	8	013			12631		
		12928	7	015			12928		
		13225	8	015			13225		
		13522	7	014			13522		

Table 9. Upper Level Winds at Robinson, IL During July, 1977.

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/20/77	0840	182	6	188	7/20/77	1420	182	13	183
		526	8	223			526	11	183
		849	11	222			849	11	177
		1173	12	218			1173	11	177
		1496	14	214			1496	9	170
		1820	14	219			1820	10	164
		2143	12	214			2143	9	165
		2467	12	206			2467	10	161
		2790	11	205			2790	10	153
		3114	9	187			3114	9	157
		3423	10	182			3423		
		3718	15	181			3718		
		4015	8	132			4015		
		4312	12	158			4312		
		4609	12	156			4609		
		4907	12	151			4907		
		5204	12	153			5204		
		5501	12	153			5501		
		5798	12	165			5798		
		6095	13	165			6095		
		6392	13	160			6392		
		6689	13	166			6689		
		6986	13	166			6986		
		7283	13	160			7283		
		7580	13	154			7580		
		7877	13	156			7877		
		8174	15	152			8174		
		8472	15	137			8472		
		8769	17	140			8769		
		9066	18	141			9066		
		9363	18	145			9363		
		9660	22	138			9660		
		9957	20	145			9957		
		10254	21	145			10254		
		10551	22	153			10551		
		10848	40	156			10848		
		11145	6	104			11145		
		11442	17	147			11442		
		11739	22	145			11739		
		12036	20	144			12036		
		12334	23	145			12334		
		12631	21	148			12631		
		12928	21	147			12928		
		13225	21	149			13225		
		13522					13522		

Table 10. Upper Level Winds at Robinson, IL During July, 1977.

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/20/77	1433	182	10	168	7/21/77	0834	182	7	218
		526	15	162			526	7	216
		849	14	166			849	14	239
		1173	16	165			1173	18	234
		1496	16	161			1496	17	230
		1820	17	154			1820	16	226
		2143	15	163			2143	17	228
		2467	13	165			2467	21	234
		2790	10	165			2790	21	230
		3114	11	155			3114	21	220
		3423	10	165			3423	21	231
		3718	20	170			3718	19	229
		4015	14	168			4015	18	225
		4312	19	166			4312	18	222
		4609	19	164			4609	16	221
		4907	20	166			4907	17	222
		5204	23	159			5204	15	216
		5501	24	161			5501	16	218
		5798	24	161			5798	14	220
		6095	25	162			6095	14	224
		6392	24	165			6392	14	227
		6689	24	167			6689	14	232
		6986	21	169			6986	16	234
		7283	23	169			7283	14	238
		7580	19	173			7580	14	247
		7877	22	173			7877	16	244
		8174	22	171			8174	16	250
		8472	23	170			8472	16	249
		8769	20	168			8769	16	250
		9066	21	166			9066	15	258
		9363	21	171			9363	17	256
		9660	18	169			9660	15	261
		9957	18	169			9957	13	233
		10254	21	175			10254	18	291
		10551	22	172			10551	14	263
		10848	22	176			10848	13	277
		11145	19	178			11145	13	259
		11442	19	182			11442	16	263
		11739	16	191			11739		
		12036	16	192			12036		
		12334					12334		
		12631					12631		
		12928					12928		
		13225					13225		
		13522					13522		

Table 11. Upper Level Winds at Robinson, IL During July, 1977.

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/21/77	1149	182	9	263	7/22/77	1540	182	17	042
		526	11	257			526	16	049
		849	11	252			849	19	050
		1173	11	256			1173	16	049
		1496	10	252			1496	10	064
		1820	11	246			1820	9	075
		2143	12	244			2143	13	069
		2467	11	263			2467	14	070
		2790	8	241			2790	15	073
		3114	7	249			3114	14	077
		3423	13	238			3423	16	086
		3718	16	232			3718	14	091
		4015	17	236			4015	9	081
		4312	16	231			4312	12	066
		4609					4609	16	068
		4907					4907	7	085
		5204					5204	11	089
		5501					5501	8	076
		5798					5798	12	060
		6095					6095	12	051
		6392					6392	12	058
		6689					6689	9	054
		6986					6986	7	066
		7283					7283	7	070
		7580					7580	9	073
		7877					7877	10	054
		8174					8174	9	049
		8472					8472	10	049
		8769					8769	11	037
		9066					9066	11	038
		9363					9363	10	063
		9660					9660	13	004
		9957					9957	11	017
		10254					10254	10	023
		10551					10551	10	032
		10848					10848	7	029
		11145					11145	13	039
		11442					11442	13	002
		11739					11739	8	078
		12036					12036	13	033
		12334					12334	15	029
		12631					12631	17	018
		12928					12928	19	020
		13225					13225	15	018
		13522					13522	17	359

Table 12. Upper Level Winds at Robinson, IL During July, 1977

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/23/77	0902	182	9	126	7/26/77	0753	182	13	054
		526	6	100			526	14	056
		849	14	140			849	22	065
		1173	19	147			1173	39	064
		1496	18	149			1496	38	064
		1820	19	148			1820	34	065
		2143	17	151			2143	29	064
		2467	11	160			2467	28	059
		2790	7	183			2790	22	063
		3114	5	212			3114	23	059
		3423	4	250			3423	16	055
		3718	3	278			3718	12	054
		4015	2	298			4015	9	055
		4312	4	282			4312	6	061
		4609	4	112			4609		
		4907	9	128			4907		
		5204	13	135			5204		
		5501	12	140			5501		
		5798	12	147			5798		
		6095	9	145			6095		
		6392	11	138			6392		
		6689	10	148			6689		
		6986	20	140			6986		
		7283	3	128			7283		
		7580	10	153			7580		
		7877	8	156			7877		
		8174	5	156			8174		
		8472	6	156			8472		
		8769	5	142			8769		
		9066	5	127			9066		
		9363	4	147			9363		
		9660	3	190			9660		
		9957	5	209			9957		
		10254	3	212			10254		
		10551	3	158			10551		
		10848	2	149			10848		
		11145	2	132			11145		
		11442	2	021			11442		
		11739	2	259			11739		
		12036	5	335			12036		
		12334					12334		
		12631					12631		
		12928					12928		
		13225					13225		
		13522					13522		

Table 13. Upper Level Winds at Robinson, IL During July, 1977

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/27/77	1200	182	6	318	7/27/77	1200	182	12	082
		526	6	315			526	9	090
		849	7	311			849	10	098
		1173	7	308			1173	11	089
		1496	8	305			1496	10	087
		1820	9	304			1820	9	098
		2143	9	304			2143	7	084
		2467					2467	11	084
		2790					2790	9	108
		3114					3114	7	100
		3423					3423	4	135
		3718					3718	5	137
		4015					4015	12	087
		4312					4312	10	099
		4609					4609	8	088
		4907					4907	9	083
		5204					5204	8	092
		5501					5501	9	088
		5798					5798	7	081
		6095					6095	8	088
		6392					6392	5	072
		6689					6689	4	054
		6986					6986	4	040
		7283					7283	4	033
		7580					7580	4	022
		7877					7877	3	022
		8174					8174	3	014
		8472					8472	4	013
		8769					8769	7	347
		9066					9066	6	335
		9363					9363	5	336
		9660					9660	6	306
		9957					9957	7	332
		10254					10254	6	315
		10551					10551	6	302
		10848					10848	7	323
		11145					11145	9	326
		11442					11442	8	326
		11739					11739	7	299
		12036					12036	7	288
		12334					12334	8	269
		12631					12631	7	282
		12928					12928	7	275
		13225					13225	201	195
		13522					13522	202	008

Table 14. Upper Level Winds at Robinson, IL During July, 1977

Date	Time	ALT (ft)	WS (mph)	WD (deg)	Date	Time	ALT (ft)	WS (mph)	WD (deg)
7/28/77	1945	182	5	067			182		
		526	12	198			526		
		849	6	187			849		
		1173	8	195			1173		
		1496	9	197			1496		
		1820	9	201			1820		
		2143	9	209			2143		
		2467	10	214			2467		
		2790	10	222			2790		
		3114	11	222			3114		
		3423	14	222			3423		
		3718	14	228			3718		
		4015	12	245			4015		
		4312	11	228			4312		
		4609	9	229			4609		
		4907	10	248			4907		
		5204	11	249			5204		
		5501	9	248			5501		
		5798	11	253			5798		
		6095	12	257			6095		
		6392	11	252			6392		
		6689	10	254			6689		
		6986	8	250			6986		
		7283	9	248			7283		
		7580	10	243			7580		
		7877	10	249			7877		
		8174	8	260			8174		
		8472	6	263			8472		
		8769	7	258			8769		
		9066	7	245			9066		
		9363					9363		
		9660					9660		
		9957					9957		
		10254					10254		
		10551					10551		
		10848					10848		
		11145					11145		
		11442					11442		
		11739					11739		
		12036					12036		
		12334					12334		
		12631					12631		
		12928					12928		
		13225					13225		
		13522					13522		